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Vol. XLV. January, 1951 No. 1.

# GENERAL ARTICLES

## PROGNOSIS IN PULMONARY TUBERCULOSIS

By Jaques Stephani
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### 1. Introduction

The first question directed to the chest specialist, even before the end of the examination, is often, " Is it serious ? " and this is generally followed by, " Shall I get all right again ? " and " How long will it take to get well ? "

It is only reasonable to refuse to answer such questions after a single examination, but all patients do not understand this, and it is sometimes necessary to explain in detail how an opinion on the prognosis of pulmonary tuberculosis requires much more than the physical and radiological examination. A recent radiograph, often tomographs, sputum tests, temperature record and other data for future reference are all essential. None of this information can be collected in one short hour, and it is a wise practice to see a patient at least twice before risking a prognosis or planning treatment, for on such decisions may depend the whole of the patient's future life.

The many factors contributing to a reasonably accurate prognosis would require a book, not a short paper, but I propose to set down here a few of them.

### 2. Constitution

Physicians are often puzzled by the fact that some patients react favourably from the outset, while others, with apparently identical conditions, go steadily downhill. A German author, Kurt Klare, has tried to explain this phenomenon by dividing his patients into two types according to their constitution. The first he named a " Reizkonstitution," which may be translated " susceptible constitution." These people are usually fair-haired with clear white skin and blue eyes—in fact, what is popularly known as the Nordic type. Throughout life they tend to be susceptible to upper respiratory infections and allergic conditions—viz., colds, bronchitis, tonsillitis, hay fever, rhinitis, asthma. Their tonsils are big and often infected and their pharynx granular. The other type embraces people with dark hair, eyes and skin. Their tonsils are small and clean, likewise the pharynx, and they tend to develop few infections. On

the other hand, the "susceptible" subject is also found among these dark people, and, curiously enough, in tuberculosis it is the susceptible people, prone to upper respiratory infections and allergic conditions, who have a better resistance and tend less to develop acute and malignant forms of the disease.

A similar approach is the racial factor: the Jews have undoubtedly high powers of resistance and recover from worse forms of tuberculosis than other races. I have noted this in both Ashkenazi and Sephardic Jews, but the Yemen Jews of Arabia are an exception. The unfavourable reactions to tuberculous infections of coloured people, particularly of North African and American negroes, are well known.

### 3. Age of the Patient

The reaction of different age groups to the same germ is noteworthy, and the following family history provides a typical illustration: a woman of 37 with a right upper lobe cavity recovered after treatment by artificial pneumothorax and pneumonolysis.

Her 5½-year-old daughter developed a broncho-pneumonic infiltration of the whole of the left upper lobe, with a fairly large cavity at the apex and an effusion in the right pleura. The cavity increased with rapidity, and there was no improvement of the condition until streptomycin was given, in conjunction with an artificial pneumothorax and an adhesion section. One brother and two sisters, aged respectively 11, 14 and 15, reacted to the same infection by enlargement only of the hilar glands.

More generally, the reactions of the different age groups may be described as follows: During fœtal life the congenital form of the disease may develop. Our knowledge of this condition is derived mainly from the cases that terminate fatally, usually within the first two months of life, and there is virtually no clinical data on the numerous survivors. With regard to inherited tuberculosis, our knowledge is equally sparse. The period from birth to 1 year is fraught with grave consequences for the infected child: massive caseous adenopathies, rapid cavitation, etc. From 1 to 5 years the outlook is somewhat better, although when cavitation does develop the prognosis is usually fatal, the case of the child already described being exceptional. Between the ages of 6 and 12 tuberculosis usually manifests itself by hilar and cervical adenopathy which is benign in its course and is generally arrested. Even when pulmonary infiltration is present serial radioscopic control shows far better healing, and in less favourable conditions of rest, than in the majority of adults. In the period over 50 or 60 pulmonary tuberculosis may become clinically more silent, but, in our experience, not necessarily more malignant.

### 4. Morphology of the Lesions

This is a most important factor in assessing prognosis accurately. With miliary tuberculosis or caseous pneumonia the prognosis may, in spite of antibiotics, be extremely grave. At the other end of the scale there are the minimal lesions—*e.g.*, small infiltrations the size of a shilling, tiny cavities 5 millimetres across, showing no sign of spread and which may indeed in some cases heal spontaneously. Between these extremes there may be, for example, an upper lobe tuberculosis with a few tiny cavities and a limited tendency to spread. On the other hand, two similar cavities may develop entirely differently

in two different individuals. Sometimes the sedimentation rate, pulse and temperature may give an indication of the development of the disease, but in others it is necessary to take a further film or a set of tomographs after a lapse of six weeks. These will reveal whether the tendency is regressive, stationary or progressive. Progression may be seen by a new metastatic infiltration, by the formation of pleural fluid on the same or opposite side, or by the increase in size of a previously almost invisible infiltration. Such a picture indicates clearly that, in spite of bed rest and antibiotics, the disease is not arrested, and examination of one X-ray film alone must not be allowed to induce optimism, since it is impossible, in the early stages, to assess the potential development of an infiltration.

### 5. Location of the Disease in the Lung

A fresh exudative infiltration the size of a shilling situated in the extreme apex—that is, in the upper part of the apical segment—is liable to be spontaneously arrested by gradual conversion into fibrous nodules and calcification. If, however, it is located 2 inches lower—that is, in the lower part of the same segment—it has a much greater tendency to ulcerate. Lower still—*e.g.*, where there is a cavity at the base of the lower lobe—it is much more difficult to heal, expecially when adhesions make an artificial pneumothorax impossible. Again, a small infiltration with a fan-shaped spread from the upper part of the hilum, which is in close communication with a main or lobar bronchus, presents a much graver prognosis than any of the other examples, since the infiltration is connected with an important bronchus.

### 6. Complications due to Involvement of Other Organs

*Lungs and Bowels.*—In spite of the use of antibiotics tuberculous involvement of the bowels demands prolonged treatment and reduces the chances of complete recovery. In any case, a long period of rehabilitation is essential.

*Lungs and Larynx.*—Although streptomycin and P.A.S. have in many cases improved the prognosis, these chemotherapeutic measures are not always successful, since laryngeal involvement occurs in those very patients who have the lowest powers of resistance.

*Lungs and Genital Organs in Women.*—This is one of the most serious combinations, for although the disease may be arrested in a proportion of cases, treatment is very prolonged. In addition to antibiotics and bed rest for a minimum of one year, the complication may require to be treated by surgery. Altitude and heliotherapy, carefully controlled, can be beneficial adjuncts to treatment, and in this connection I should like to express my belief in the value of altitude in the treatment of tuberculosis generally.

*Lungs and Kidneys.*—Every specimen of urine that contains leucocytes without evidence of mixed infection ought to be inoculated into a guinea-pig, even if the patient has no symptoms or clinical signs. Tuberculosis of the kidney develops three to five times as slowly as that of the lung, and if adequately treated from the outset it may be arrested with streptomycin and P.A.S. alone. When ulceration is obvious the kidney must, however, be removed. But since only 50 per cent, of operated patients remain alive after five years the prognosis of combined renal and pulmonary tuberculosis is always very grave.

### 7. Mixed Infection

The small apical cavity that heals slowly by spontaneous resolution into a scar is very different from the same cavity in association with bronchitis and congestion of the whole lobe, due to a mixed infection spreading along the bronchi that are related to the tuberculous lesion. Such conditions are common, where the small cavity heals while the non-tuberculous lung trouble may take years to settle down. Bronchitis may recur several times a year, even when the condition appears quiescent, and I have had a patient who has had to spend several winters in the mountains before achieving complete recovery. Eventually, however, cavity closure has occurred and the sputum has become free from tubercle bacilli. Another patient of mine had an infiltration located near the hilum and the raised temperature, due mainly to a mixed infection of the bronchi, dropped only in response to penicillin therapy.

### 8. Pulmonary Tuberculosis combined with Other Morbid or Particular Physiological Conditions

Pulmonary tuberculosis may be associated with a number of non-tuberculous conditions, of which we may consider some of the more striking examples.

*Diabetes.*—Irrespective of age, diabetes always produces a more serious prognosis, particularly in children and young people. The best mode of treatment is to give as many calories as required, with sufficient insulin to control the diabetes, and to deal with the tuberculous condition in the usual way.

*Bronchiectasis.*—A cavity at the apex, complicated by bronchiectasis of the lower lobe, must be regarded from the outset as a serious condition. Even if the cavity becomes collapsed and scarred, removal of the lung involves a grave risk and should be carried out only if the other lung is healthy.

*Pregnancy.*—There has been much greater optimism during the last decade in the face of a combination of tuberculosis and pregnancy, and the prognosis is often good, largely owing to the development of collapse therapy and of the antibiotics. For example:

> A woman of 25, two months pregnant, had an inch-long cavity. A pneumothorax was induced, the adhesions were divided, and before term the cavity was closed. Three years later the patient remained fit. Another woman, aged 28, had a cavity of ½ inch in each lung. She was treated by bed rest alone; the day after the birth of the child a course of streptomycin was initiated and one month later an artificial pneumothorax was induced on the more active side. Both cavities became closed and the disease was arrested.

Provided that tuberculous foci are limited and the general condition is good, my own feeling is that pregnancy does not make the prognosis any worse.

### 9. Age of the Disease Process in the Lungs

As a general rule the longer the tuberculous process has remained unhealed the worse the prognosis. Cavities may increase in size with age, the walls become less elastic and are surrounded with indurated scars and nodular dissemination. Peripheral extension of the disease reacts upon the pleura. Consequently, if a pneumothorax is induced the adhesions will be thicker and

more extensive. Among these older tuberculous conditions must be included those where, for some reason or another, thoracoscopy has been long delayed. When an artificial pneumothorax is left for a year or more with adhesions the pleura becomes thick and opaque, rendering endopleural pneumolysis difficult, if not impossible. As a further complication fluid may have developed. Briefly, the outlook for a successful adhesion section may have become technically poor. Finally, if lesions of long standing are left untreated, metastatic foci are likely to develop on the other side.

### 10. General Condition of the Patient at the Outset of Treatment

The object of treatment—rest, antibiotics, collapse therapy, etc.—is to aid the resistance and healing powers of the patient. Some patients respond remarkably well to treatment, showing from the beginning a satisfactory blood sedimentation rate, low pulse, little or no fever, no undue lowering of blood pressure and a steady increase in weight. In such cases, provided the local condition is not unduly serious and that the therapeutic problem can be dealt with satisfactorily, the prognosis is nearly always good. A high sedimentation rate and poor general condition, as evidenced by rapid pulse, shortness of breath and poor vital capacity, suggests a bad outlook, and a conservative programme of treatment is advisable in the hope that collapse measures may be initiated at a later stage without undue risk of complications. In cases with tuberculosis predominantly in the apical segments I generally advise the semi-recumbent position for at least eighteen out of the twenty-four hours.

### 11. Character of the Patient and his Family

It is my practice to emphasise to the patient, after the first examination, the importance of will power and self-discipline, which account for some 50 per cent. of successful cures. I explain how the effort must not be an isolated one, but prolonged for many months, not only during the " cure," but in the later and difficult period of rehabilitation. The patient must maintain a continuously positive attitude to his disability. Unsettled people, incapable of a steady effort, yet sometimes manifesting a false activity that reveals incapacity to fix on something worth while or to relax, can scarcely hope for a favourable prognosis, for they will seldom adhere to the programme prescribed for them—viz., rest cure, early bed, avoidance of smoking and alcohol, etc.

Moreover, the patient must not be considered in isolation, for his family also has a part to play. The family may be constructively helpful, but all too often its effect is negative. Members of the family may not understand why a healthy-looking, sun-tanned fellow in good general condition should continue to be treated as a patient. Why should he rest two hours after lunch, retire early to bed and avoid strenuous efforts, while the rest of the family works from morning to night? Before assessing a long-term prognosis it is usually wiser to know something of the future home environment of the patient. For example, I recently had under my care a young woman whose husband, though comfortably off, refused her a second servant. In consequence she had to climb a

daily average of 600 stairs, in spite of a right artificial pneumothorax and an extensive left lung infiltration which had begun to heal spontaneously. After a year at home the patient showed signs of tuberculosis of the right kidney.

### 12. Programme of Treatment

The reader may perhaps wonder why this item should enter into a consideration of prognosis, for one is inclined to assume that the best possible treatment will have been decided upon from the beginning. Experience, however, shows that this is not always the case.

All physicians do not have the same ideas on the treatment for a particular case, and some of the measures prescribed are not reversible—for instance, evulsion of the phrenic nerve, or even mere crushing or alcoholisation. A patient coming to a sanatorium for further treatment with an artificially embarrassed respiratory function of this nature begins with a heavy handicap. Again, a patient with a medium-sized cavity and pleural involvement may be unable to have either an artificial pneumothorax or an " extra-pleural." The alternatives are thoracoplasty or resection, with greater attendant risks.

### 13. Mode of Life during and after Rehabilitation—Occupation

This is a very important factor in the assessment of prognosis, as the following examples will show: A man aged 50 had a cavity 1 inch in diameter which was closed by conservative treatment. On discharge he returned to his orchard, where he was required only to supervise his work-people and do some book-keeping, an ideal occupation for his disability as was shown by an examination two years later. Another patient with a similar condition was an engineer in a coal-mine and unable to change his profession. The likelihood of relapse was, therefore, very much greater in his case. A third patient with a small cavity and apparently free pleura would, if treated by artificial pneumothorax and adhesion section, have been unable to have refills from an experienced specialist in the country where he had to work. This course of treatment had, therefore, to be abandoned and a less satisfactory alternative with a less favourable prognosis selected, owing to his residential circumstances. A fourth patient, a man of 39, had four small cavities in the posterior apical segment. The pleura was free, so that an artificial pneumothorax would be possible, but certain regulations connected with his work would disqualify him permanently for his job if a pneumothorax were to be performed. A conservative course of treatment had, therefore, to be adopted (streptomycin, P.A.S., recumbent position for eighteen hours daily, at an altitude of 5,000 feet). The cavities took seven months to close and fifteen months elapsed before the patient could return to work.

## Conclusion

In dealing in some detail with these various points it has been my aim to demonstrate that the prognosis depends on many factors, not all medical, and that it cannot be determined with accuracy after a single consultation.

# PULMONARY AGENESIS

By F. S. W. Brimblecombe

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In the past pulmonary agenesis has seldom been considered as a differential diagnosis in clinical medicine. A study of the literature, however, shows that the number of such cases being reported is steadily increasing and that in recent years the diagnosis has often been made in life, although previously the correct diagnosis was usually made only at autopsy.

The first description of the condition was made by Haberlein in 1787 of a soldier aged 20, who at autopsy was found to have complete absence of his left lung.

More recently the subject has been reviewed by Hurwitz and Stephens (1937), Deweese and Howard (1944), and by Burger (1947), who brought the number of recorded cases up to 55 and who mentions several other case reports in the literature not included in that series. In addition, Field (1946) has described 14 cases, although in the last 2 cases in her series the diagnosis is not certain, since a full investigation was not carried out.

Further reports by Bowden (1947); Nesbit, Paul and Middleton (1947); Fontan, Verger, Mouliès and Martin (1947); Yount (1948); and Naclerio and Huchberg (1950) have recently been added to the literature. Four further cases are now recorded, so that there are now reports of at least 80 cases available.

Pathologically the findings may vary from complete absence of bronchus, pulmonary tissue and pulmonary vessels of the whole or part of a lung to hypoplasia of a pulmonary segment with normal bronchi and pulmonary vessels. It is suggested by Field (1946) that this latter condition may be reversible and that full development of the hypoplastic segment can occur.

Schneider (1909) has divided the pathological findings into three groups:

(1) Complete absence of bronchi, lung parenchyma and pulmonary vessels.
(2) A bronchus ending in a blind pouch, absence of parenchymal lung tissue and pulmonary vessels.
(3) Normal bronchus, with hypoplastic lung parenchyma, and with pulmonary vessels reduced in size.

Pulmonary agenesis is frequently associated with other congenital abnormalities and in particular with congenital heart disease, but it may occur as an isolated abnormality. Either lung may be affected, and occasionally both lungs, as described by Allen and Affelbach (1925) and by Foster, Verger, Mouliès and Martin (1947).

Embryologically the trachea and lung buds have been described by Arey (1937) as first being recognisable in the 3-mm. embryo, as a groove-like evagination arising on the ventral side of the œsophagus. From the posterior end of this groove two small lung buds grow out. By the fifth week the trachea and œsophagus have become separated by a constriction interrupted at its cephalic end by the larynx. Muscle fibres and cartilaginous rings are differentiated from

the surrounding mesenchyme by the seventh week. During the next few weeks hollow evaginations grow out into the envelope of connective tissue, enlarge rapidly and branch to produce the tree-like bronchial system. Pulmonary agenesis of the first two types described by Schneider, therefore, would seem to be determined before the end of this phase.

Pulmonary agenesis may be met with at all ages, the oldest known patient with the condition, described by Heerup (1927), living till the age of 72. Such cases are unlikely to give rise to symptoms and may be only discovered at routine examinations. Severe cases and cases associated with other congenital deformities and especially congenital heart disease, however, may have symptoms usually of cyanosis and dyspnœa from birth. In such cases the prognosis is poor, so that the condition is more likely to be encountered in infants and small children than in older subjects. The sexes appear to be equally affected.

Clinically there may be flattening of the affected side of the chest, although in a large number of the cases reported this has been minimal and sometimes absent, belying the gross abnormality within the thoracic cage.

The physical signs in the chest are identical with those of pulmonary collapse of a comparable degree, although bronchial breathing is a more constant feature. In cases where only a small segment of lung parenchyma is involved, however, physical signs may be entirely absent. The clinical diagnosis is confirmed by bronchography and sometimes bronchoscopy.

### Case I

D. W. was admitted to St. Mary's Hospital on 14.5.49 at the age of 5 months because of her failure to gain weight. She had been born after a normal pregnancy, at full term, weighing 7 lb. 2 oz. She had been noticed from birth to have rapid respiration, which had persisted until the time of her admission. During the first month of life her hands and feet had been noticed to go blue, but this had not been seen subsequently. She was a fourth child of healthy parents who were first cousins. The first child had died at the age of 11 days, but the second and third children were healthy.

On examination she was found to be moderately well nourished, there was no cyanosis and no clubbing of the fingers. Her respiratory rate was 34/min. and the alæ nasi were not moving.

Examination of the chest showed some asymmetry, the right hemithorax tending to be flattened. The trachea, however, was grossly deviated to the right and the movement on the right side of the chest was markedly diminished. The right hemithorax was dull to percussion, except for a small area of resonance in the right axilla. No cardiac impulse was palpable, and there was no area of cardiac dullness in the left chest. The heart sounds were best heard in the third and fourth right intercostal spaces 1 inch to the right of the sternum. There were no cardiac murmurs. The breath sounds over the right lung were bronchial in character and there were numerous rhonchi all over the right chest. The breath sounds in the left lung were normal. Examination of all other systems was normal.

#### *Investigations*

*X-ray of Chest*

There was complete opacity of the right hemithorax with gross shift of the mediastinum to the right. No cardiac shadow was visible to the left of the mid-line.

FIG. 1.—CASE I. AGENESIS RIGHT UPPER AND MIDDLE LOBES. MARKED MEDIASTINAL SHIFT TO RIGHT WITH LEFT LUNG EXTENDING INTO RIGHT HEMI-THORAX. COMPLETE OPACITY RIGHT UPPER AND MIDDLE ZONES WITH SOME AERATION AT RIGHT BASE.

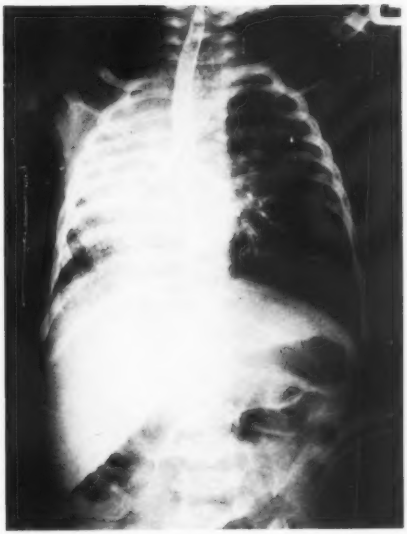

FIG. 2.—CASE I. RIGHT BRONCHOGRAM. RIGHT UPPER LOBE BRONCHUS ENDS BLINDLY; RIGHT MIDDLE LOBE BRONCHUS NOT VISUALISED; SOME FILLING OF RIGHT LOWER LOBE PRESENT.

FIG. 3.—CASE III. AGENESIS LEFT LUNG. MARKED MEDIASTINAL SHIFT TO LEFT WITH RIGHT LUNG EXTENDING INTO LEFT HEMI-THORAX IN APICAL REGION. RIGHT HEMI-THORAX OTHERWISE OPAQUE.

FIG. 4.—CASE III. AUTOPSY SPECIMEN (ANTERIOR VIEW). HYPOPLASIA LEFT LUNG WITH HYPERTROPHY OF RIGHT LUNG.

*To face p. 8*

FIG. 5.—CASE III. AUTOPSY SPECIMEN (POSTERIOR VIEW). HYPOPLASIA OF LEFT LUNG.

FIG. 6.—CASE III. AUTOPSY SPECIMEN (ENLARGEMENT OF POSTERIOR VIEW), SHOWING HYPOPLASIA LEFT LUNG.

FIG. 7.—CASE IV. AGENESIS LEFT LUNG. MARKED MEDIASTINAL SHIFT TO LEFT, OPACITY OF LEFT HEMI-THORAX.

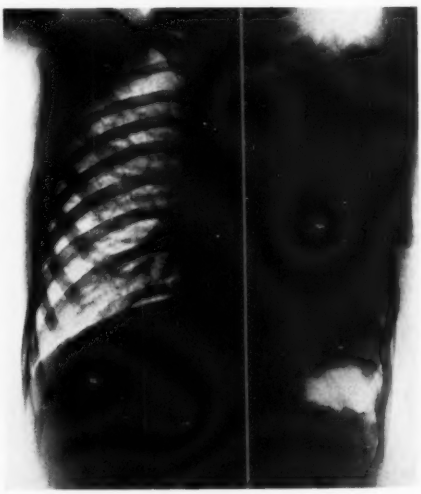

FIG. 8.—CASE IV. BRONCHOGRAM. NO FILLING OF LEFT LUNG. RIGHT BRONCHIAL TREE SHOWS TWO LARGE BRONCHI SUPPLYING THE RIGHT UPPER LOBE.

*To face p. 9*

*Screening*

Although the heart was deviated markedly to the right there was no dextrocardia. There was no evidence of clear-cut lobar atelectasis.

*Bronchogram* (Fig. 2)

The right upper lobe bronchus ended blindly in a sac-like dilatation. There was no evidence of a right middle lobe bronchus. The right lower lobe bronchus appeared normal, although only partial filling of the right lower lobe was obtained.

Whilst in hospital her respiratory rate decreased and the adventitious sounds disappeared from the right lung.

Further X-ray of the chest (Fig. 1) showed some aeration to be present at the right base. The rest of the right hemithorax, however, remained opaque.

She was discharged home on 20.6.49. Her subsequent progress has been most satisfactory. Her physical milestones have been passed at the normal times and now at the age of 22 months she is talking and running about. Her exercise tolerance, however, is far below that of a normal child, although she is not now dyspnœic at rest.

She has survived two attacks of acute bronchitis which were treated with oral sulphonamides and systemic penicillin from the onset.

Physical examination now shows no evidence of cyanosis or clubbing of the fingers and there is now no asymmetry of the chest wall. Gross mediastinal shift to the right, however, is still present, and the heart sounds are best heard to the right of the sternum. There is now a larger area of resonance at the right axilla and at the right base than previously, and in this area normal breath sounds can be heard.

X-ray of the chest still shows complete opacity of the right hemithorax except for a slightly larger area of aeration at the right base; there is still gross mediastinal shift to the right.

The diagnosis is one of agenesis of the right upper and middle lobes. The eldest sister of this child had died at the age of 11 days. The clinical and autopsy findings in her case have kindly been given to me by the Post-graduate Hospital, Hammersmith, and are now described as Case II.

## Case II

Y. W. was born at the Post-graduate Hospital, Hammersmith, on 7.6.41. She was the first child of healthy parents who were first cousins, and was born after a normal pregnancy and labour, weighing 6 lb. 14 oz. She was noted to be cyanosed from birth and to be dyspnœic. A provisional diagnosis of pulmonary atelectasis was made, and on 18.6.41, there being no clinical improvement, it was decided to perform a bronchoscopy. Death occurred whilst this was being carried out.

*Autopsy*

On opening the thorax the left lung was found to be extremely large, extending into the right hemithorax and displacing the heart and mediastinum to the right.

The right lung was grossly deformed, the right upper lobe and middle lobe bronchi ending as saccular buds. The right lower lobe bronchus appeared normal. There was no parenchymal lung tissue applied to the right upper and middle lobe bronchi. The right lower lobe was present, but collapsed, and appeared to be bound down to the pericardium.

The heart was normal, there being no patency of the inter-atrial or ventricular septa; the ductus, however, was patent.

On section the left lung was found to be emphysematous and to contain small areas of infarction.

The parents of these children and their other two children have been found on clinical and radiological examination to show no evidence of pulmonary agenesis.

### Case III

F. H. was admitted to the Hospital for Sick Children, Great Ormond Street, on 30.7.49 at the age of 10 days. She had been born after a normal pregnancy and delivery at full term, weighing at birth 5 lb. 11½ oz. Her parents were healthy and not related before marriage. Three siblings are alive and well, but one had died of bronchopneumonia.

She had been noticed to become cyanosed during her feeds for the first four days of life, after which time she remained well until the day before her admission, when she developed rapid respiration with blueness of the lips.

Examination showed her to be poorly nourished; there was slight cyanosis of the lips, but no movement of the alæ nasi. There was no clubbing of the fingers. There was marked flattening of the left side of the chest, which contained a deep sulcus not present on the right side. The trachea and heart were markedly deviated to the left, and there was dullness to percussion all over the left chest. The breath sounds were diminished throughout the left chest and normal over the right chest. No adventitious sounds were heard. The heart sounds were normal. All other systems were normal.

#### *Investigations*

X-ray of her chest (Fig. 3) showed an opacity in the left mid and lower zones, the heart being displaced to this side. The appearances were not typical of collapse and suggested rather a partial agenesis of the left lung.

In view of the fatal result of bronchoscopy in Case II it was decided that neither this procedure nor bronchography should be carried out at this stage.

Her condition improved in hospital with the help of oxygen, and she was discharged home on 6.8.49, with the diagnosis of agenesis of the left lung.

She remained well until 8.11.49 when she developed an upper respiratory tract infection which appeared to improve but on 15.11.49 she was found dead in her cot.

#### *Autopsy*

The body was found to be in fair nutritional state, measuring 25 inches in length and weighing 8 lb. The anterior and lateral aspects of the left chest were considerably flattened.

On opening the thorax (Fig. 4) the mediastinum was found to be markedly shifted to the left, so that the heart was completely contained in the left hemithorax. The right lung was much larger than normal and extended into the left side of the chest, particularly in the apical region.

The trachea was markedly deviated to the left. At its lower extremity it divided into right and left main bronchi, but the left main bronchus then terminated after a distance of only 6 mm. The right bronchial tree appeared normal.

The left lung comprised a small nodule of pulmonary tissue applied to the tip of the left main bronchus measuring 2 cm. × 1·5 cm. × 0·6 cm. Lobulation of the lung could be recognised, as the organ was divided by two fibrous septa

into approximately equal components. Except for a small space lined with serous membrane in the left costo-phrenic angle, no pleural cavity was found in the left hemithorax. The bony thoracic cage was markedly contracted by means of a transverse and a longitudinal sulcus.

The left pulmonary artery was an extremely fine channel, 1 mm. in external diameter, entering the rudimentary left lung on its anterior aspect. Although sought for by careful dissection, the venous outflow from this organ could not be detected.

The right lung was larger than normal and the anterior portions were emphysematous, although this area also contained patches of lobular collapse. The right pulmonary artery and veins were of normal size.

Examination of the heart revealed gross congenital deformities. The right atrium was moderately dilated and the foramen ovale was widely patent.

In addition there was a considerable deficiency of the lower part of the inter-atrial septum which was continuous with a defect in the inter-ventricular septum. This atrio-ventricular canal was circular in outline, with a diameter of 1·5 cm. The left pulmonary artery was markedly hypoplastic. No pulmonary veins could be detected entering the left atrium.

Examination of the other systems revealed no abnormalities.

The clinical diagnosis of agenesis of the left lung was thus confirmed, and in addition the presence of a congenital cardiac anomaly in the presence of a patent atrio-ventricular septum which had been undiagnosed in life was discovered at post-mortem.

### Case IV

H. T. was referred to the Hospital for Sick Children, Great Ormond Street, on 19.9.49 at the age of 2 years, because a cardiac murmur had been detected at routine examination.

She was an only child of healthy parents. The pregnancy and confinement were normal and her birth weight was 7 lb. For the first twenty-four hours of life she was cyanosed, but no further cyanosis had occurred subsequently. There was no complaint of dyspnœa or other symptoms, and her physical and mental progress had been satisfactory.

Examination showed her to be well nourished and there was no cyanosis or clubbing of the fingers.

There was flattening of the left side of the chest and the movement was diminished on this side. The trachea was shifted to the left and there was impaired percussion all over the left side of the chest. The air entry was reduced in the left axilla and at the left base.

Examination of the heart showed a systolic thrill to be present. This was maximal above the left clavicle, but could also be felt in the pulmonary area and in the neck. There was a harsh systolic murmur audible in all areas which was maximal in the pulmonary area. Subsequent examinations revealed the appearance of a continuous murmur heard best in the second and third left spaces. Her blood pressure was 105/60.

Examination also showed a dorsal scoliosis to be present, and the right shoulder was held higher than the left.

*Investigations*

*X-ray of Chest* (Fig. 5)

The left hemithorax was opaque. There was marked deviation of the trachea and mediastinum to the left. The heart was completely contained in the left hemithorax.

*Bronchogram* (Figs. 6 and 7)

The right eparterial bronchus arose above the carina and separated into three main branches. An additional bronchus arose below the carina on the right side, which divided into two main branches. Below this the bronchial distribution to the right middle and lower lobes was of a normal pattern.

The left main bronchus ended blindly ¼ inch from the carina.

*Bronchoscopy* (by Professor Pilcher)

This confirmed the abnormal origin of the right eparterial bronchus above the carina. The left main bronchus appeared extremely small and could not be entered with the bronchoscope.

*X-ray of Spine*

Right-sided cervical rib present. The fourth and fifth dorsal vertebræ are represented as hemi-vertebræ. There is a dorsal scoliosis.

Her subsequent progress has been most satisfactory, but there has been little change in the clinical signs in the chest or in the X-ray appearance.

The diagnosis is one of multiple congenital deformities:

(1) Agenesis of the left lung.
(2) Abnormal bronchial tree in right lung.
(3) Congenital heart disease, probably patent ductus arteriosus.
(4) Cervical rib.
(5) Fourth and fifth dorsal hemi-vertebræ.

*Comment*

As well as the agenesis of the left lung found in this case, there is additional evidence of the presence of abnormal pulmonary development as shown by the additional bronchus supplying the right lung.

## Discussion

There appears to be no precedent in the literature for the appearance of identical pulmonary agenesis in two siblings of a first-cousin marriage, as occurred in the first 2 cases described above. Yount (1948) described twins, one of whom was discovered at autopsy to have agenesis of the entire right lung and in which the other twin has had a similar diagnosis made during life. These twins are said to have been identical, as shown by a single placenta and amniotic sac. There is no reference to any further investigation to confirm their identicality, however, nor is there mention of the presence or absence of parental consanguinity. Finkelstein, quoted by Field, also described what are said to have been uniovular twins, who lived for one week. At autopsy, one had a rudimentary left lung and the other a rudimentary right lung.

Apart from these cases, I have found no record of the condition occurring in siblings.

In Cases I and II above the likelihood of the condition being a result of a Mendelian recessive inheritance, hitherto undescribed, appears to be overwhelming, in view of the consanguinity of the parents. It is not suggested, however, that such a characteristic is common to all cases of pulmonary agenesis, for the extent and site of the deformity vary from case to case, as does the

association with congenital abnormalities in other parts of the body. It may be that certain other cases of pulmonary agenesis may be genetically determined, but at present the evidence is insufficient to form any conclusions.

Although many of the cases described are associated with multiple congenital defects, I found no case among those recently recorded in which maternal rubella could be invoked as an etiological factor.

In recent years the diagnosis of pulmonary agenesis has been made on clinical grounds in at least 20 of the cases described, including Cases I, III and IV above. A large number of the recorded cases have been noted to have cyanosis and dyspnœa from birth, although once the first few months are passed these signs usually disappear, due perhaps to the hypertrophy of the existing pulmonary tissue. As the condition is often associated with other congenital anomalies, as in Cases III and IV, the finding of multiple abnormalities should be regarded as an indication to look for the presence of a possible pulmonary agenesis. In other cases there may be no symptoms or associated abnormalities and the condition may be discovered at routine examination.

The absence of asymmetry of the chest has been commented on in many of the recorded cases, although in the 3 cases in this series, in which the diagnosis was made in life, definite asymmetry was present in each case. Gross displacement of the heart and mediastinum is a constant feature in severe cases, however, together with impairment of percussion and diminished air entry on the affected side. Clubbing of the fingers was not found in these cases.

Confirmatory evidence of the clinical diagnosis is best obtained by bronchography. Bronchoscopy may be a dangerous procedure in this condition in the neonatal period, but is of value in older children and in adults.

In the neonatal period the condition may be indistinguishable from atelectasis, although asymmetry of the chest may help to suggest pulmonary agenesis. The persistence of the abnormal physical signs and the appropriate radiological picture may lead to the true diagnosis being made.

In infancy enlargement of the thymus as shown by chest X-ray may occasionally be confused with pulmonary agenesis, particularly if the thymus shadow is found to be unilateral. This appearance has been well described by Kemp, Morley and Emrys-Roberts (1948) as a sail-like triangular projection extending out from the mediastinum. In some of their cases of thymic enlargement the mediastinum was found to be displaced towards the side of the shadow, as would occur with a partial pulmonary agenesis. Even time will not always solve this problem, because, although it is known that the shadow cast by the thymus diminishes as the child grows older, so also, if the hypothesis of Field is correct, may a hypoplastic lung segment grow to its normal size, and the abnormal X-ray appearances disappear.

Persistent pulmonary collapse occurring in young children due to enlarged mediastinal glands, following whooping-cough or pneumonia, and occurring secondarily to mediastinal or bronchial cysts, may also lead to diagnostic difficulty. In such cases bronchoscopy and bronchography are of the greatest value in determining the diagnosis.

No active treatment is indicated for these children, but respiratory illnesses should be treated by early and extensive chemotherapy. All measures to avoid respiratory infections, including treatment of the upper respiratory tract if

this is a source of infection, should be employed as soon as the indication arises.

The prognosis often depends more upon the severity of any associated congenital heart lesion than upon the degree of pulmonary agenesis. Even if one lung is entirely absent, provided that the heart is normal and the other lung remains healthy, the expectation of life may not be in any way reduced. In some cases, however, emphysema of the previously normal lung may occur and so worsen the prognosis. The critical period appears to be the first six months of life. Once this period is survived the majority of the remaining cases may be expected to reach adult life. Of 50 cases analysed, 21 were found to have died before the age of 6 months and 2 further cases died before the age of 2 years. Eighteen cases had survived till over the age of 5 years, while the remaining 9 cases were alive under the age of 5 years. Of the cases that had survived until over the age of 5 years, several had died of unrelated causes such as motor accidents, 3 had survived until the ages of 58, 65 and 72 years respectively. In 4 cases only in which death took place between the ages of 5 years and 30 years could the pulmonary agenesis be said to have been a contributory cause; in each of these cases the cause of death was bronchopneumonia of the previously healthy lung.

## Summary

(1) The literature concerning pulmonary agenesis is reviewed and the pathology described.

(2) Four cases are described, in which two are siblings of a first-cousin marriage.

(3) The etiology, clinical diagnosis and prognosis of the condition are discussed.

My thanks are due to Dr. Reginald Lightwood for permission to publish Cases I and III, to Dr. Wimbush for permission to publish Case II, and to Dr. Bonham Carter for Case IV; to Dr. Rohan Williams for permission to show the X-rays of Case I, and to Dr. Blair for the X-rays of cases III and IV; to Dr. Cardew for the X-ray photographs of Case I, and to Derek Martin, Esq. for the photographs of Cases III and IV; to Dr. Reginald Lightwood and Dr. Martin Bodian for helpful criticism.

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# MINOR RESPIRATORY INFECTIONS

## The Importance of Their Diagnosis and Treatment

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### Introduction

The diagnosis and treatment of respiratory infections have been considerably improved in recent years by the increased use of radiology and chemotherapy. Formerly, the more serious illnesses claimed the greatest attention, although clinical observation was very acute, and Laënnec, in the early nineteenth century, asserted that he and his pupils could diagnose the presence of an area of pneumonic consolidation of the size of an almond (Laënnec, 1826). Nowadays, the presence of very small areas of pneumonic consolidation or collapse is frequently noted as the result of the increased use of radiography. The frequency with which these are found depends on the extent to which radiography is used. A corollary is that many cases of this type of respiratory infection are not diagnosed unless they happen to be subjected to radiography.

Routine radiography, including mass radiography surveys, has revealed the presence of abnormal, transient, radiographic shadows in the lungs of a number of patients with only mild respiratory infections (Ramsay and Scadding, 1939; Trail, 1944). These may be due to minimal areas of inflammatory consolidation caused by bacteria of relatively low-grade virulence (Maxwell, 1938); they may also be caused by a virus or by a secondary bacterial invader. On the other hand, they may be examples of very small areas of collapse of the lung, or be caused by aspiration of material down the air passages which may become secondarily infected (Ramsay and Scadding, 1939).

If, as is probable, a large number of these transient shadows represent areas of pulmonary collapse, their importance in initiating, or perpetuating, a state of affairs in which the end point is bronchiectasis or chronic bronchitis may be considerable. In any case they may take a part, by facilitating further such infection, in the natural history of chronic pulmonary disease.

### Description of Cases

#### Incidence

Sixty-nine persons with abnormal transient radiographic shadows of the lungs were discovered as a result of routine examination, by a mass radiography unit, of a total of 38,346 persons. The incidence is 1·8 per thousand persons. Those with increased density of the normal lung markings only were not included. These were all young male adults and the majority of their ages lay between 21 and 25 years inclusive. Their health had been considered sufficiently good for them to serve overseas in the Forces, whence the majority had, in fact, recently returned. There was no evidence to suggest any disease of the rickettsia or psittacosis groups.

The incidence of respiratory infections as a whole was not determined. The

numbers were fairly equally scattered throughout the year, and they were not part of any influenzal or similar epidemic. None of the patients reported sick and would probably have not been examined if the abnormal shadow had not been detected. In most cases they did not feel ill and were afebrile with manifestations of an upper respiratory infection only. This was similar to many a " common cold " they had experienced before and it was difficult to explain to them that there was any abnormality in their lungs; this was made especially difficult by the lack of a suitable descriptive name for this type of respiratory infection. The finding of an abnormal shadow in the lungs caused much anxiety, as it was known that mass radiography was primarily for the detection of pulmonary tuberculosis. All made a satisfactory recovery. Two patients only were confined to bed. The rest were sent home on a period of three or four weeks' sick leave and re-examined, and this procedure was repeated if the abnormal shadow had not cleared.

### Previous Health

Twelve patients (17·3%) stated that they were subject to frequent coughs and colds, or bronchitis. Six (8·7%) had previously had pneumonia, and two of these had since suffered from frequent coughs and colds. One had severe " influenza " five years ago; one always suffered from hay fever, and another from asthma. Thus a total of at least 21 (30·5%) suffered from previous respiratory illness.

### Symptoms

Five patients (7·2%) were without any symptoms at the time of their examination; of these three (4·3%) developed symptoms during the following week and two (2·9%) remained symptom-free. Six (8·7%) had symptoms for from four to six weeks before examination, four (5·8%) for three weeks, twenty-three (33%) for one week, and sixteen (23·2%) for less than a week.

Symptoms were very mild. Seventeen (24·6%) said that they felt " off colour "; of these, only two (2·9%) who had a raised temperature and who were admitted to the sick quarters felt ill enough to warrant their being confined to bed. Four (5·8%) shivered slightly, two (2·9%) felt excessively cold and four (5·8%) felt very hot at the onset. Three (4·3%) lost their appetite and one (1·4%) had some epigastric discomfort. One (1·4%) had generalised muscular aching at the onset, one had a slight sore throat, and three were slightly hoarse. Five (7·2%) complained of soreness, three (4·3%) had tightness of the front of the chest, and four (5·8%) had slight pains in other parts of the chest. Eight patients (11·6%) had a slight headache at the onset. There was no apparent correlation between the character or the severity of the symptoms and the radiographic appearances. All except two, who had no symptoms at any time, had nasal catarrh, and fifty-three patients (76·8%) had a cough and sputum at some stage of their illness.

The minimal duration of symptoms was approximately seventeen days and the maximal duration was approximately eight weeks from the onset. The average duration, excluding those cases which were symptom-free, was approximately twenty-eight days.

## Physical Signs

Thirteen patients (18·8%) looked unwell. Herpes labialis was present in three (4·3%), and in two (2·9%) there were slightly enlarged, non-tender, cervical, lymphatic glands.

Nasal catarrh of varying degree was found in all except nine cases.

Physical signs in the chest were found in thirty-one cases (44·9%); if they had been examined more frequently during their illness, signs might have been found in a greater number. There was no clubbing of the fingers.

Abnormal physical signs in the chest occurred singly as the only clinical abnormality or in various combinations, as follows:

| *Abnormal Physical Signs* | *Number of Cases* |
|---|---|
| Crepitations only | 10 (14·5%) |
| Crepitations and rhonchi | 3 (4·3%) |
| Absent or decreased breath sounds only | 3 (4·3%) |
| Rhonchi only | 2 (2·9%) |
| Decreased breath sounds and dullness | 2 (2·9%) |
| Dullness and crepitations | 2 (2·9%) |
| Bronchial breathing only | 2 (2·9%) |
| Decreased breath sounds and crepitations | 1 (1·4%) |
| Decreased breath sounds and movement, dullness | 1 (1·4%) |
| Decreased movement only | 1 (1·4%) |
| Bronchial breathing, inc. vocal resonance, crepitations | 1 (1·4%) |
| Bronchial breathing and crepitations | 1 (1·4%) |
| Bronchial breathing, inc. vocal resonance | 1 (1·4%) |
| Bronchial breathing, inc. vocal resonance, dullness | 1 (1·4%) |

## Laboratory Investigations

Sputum examinations were carried out in fifteen patients only (21·7%); normal upper respiratory flora were present in eleven cases, and in four the sputum contained pneumococci which were not typed.

Blood counts were performed in thirty-two cases (46·6%); there was no evidence of anæmia, and the total white cells ranged between 4,500 and 10,900 per cu. mm. The differential counts showed no abnormality.

The erythrocyte sedimentation rate (Westergren) was performed in twenty-seven cases (39%). In three cases this was 23, 21 and 17 mm. per hour respectively, and in the others it ranged from 1 to 8 mm. per hour. Cold agglutination tests were carried out in six cases (8·7%) and no abnormal rise in titre was found.

## Radiology

The abnormal shadows were distributed in the zones of the lung fields in the following manner:

| | *R. Lung* | *L. Lung* | *Bilat.* |
|---|---|---|---|
| Upper Zone | 9 (13%) | 11 (15·9%) | 1 (1·4%) |
| Middle Zone | 6 (8·7%) | 4 (5·8%) | 1 (1·4%) |
| Lower Zone | 23 (33%) | 9 (13%) | 5 (7·2%) |

In a few cases shadows at the extreme apex were hidden behind bony structures. It is in this kind of case that the use of an antero-posterior view with a tilt as an additional routine view is helpful; this was used for a series of

miniature films and was considered to produce a much greater efficiency in the detection of abnormal shadows.

Approximate comparison of the size of the abnormal shadow with that of the radiographic appearance of a broncho-pulmonary segment reveals that twenty-eight (40%) were larger, thirty-five (50·7%) were about the same size and six (8·7%) were smaller. No shadow occupied the whole of a lobe except in the case of the right middle lobe. On the whole the larger shadows were situated in the lower zones.

There appeared to be three main elements which existed together in various proportion, or separately—a homogeneous, ill-defined shadow of light density; increase in size and density of the normal lung markings; and a mottled appearance due to the presence of very small, dense, scattered opacities. The latter two elements were often exaggerated and brought into relief by a background of increased translucency due to emphysema. The association of emphysema with these multiple small opacities suggested that the latter might be areas of collapse.

In some cases the same elements could be seen, but the whole shadow was more dense and the heavy striations converged together. Some definite evidence of collapse of part of a lobe, based on the presence of compensatory emphysema and converging striations, was present in at least fourteen cases (20·9%). In one case there was slight displacement of the heart to the affected side with a raised diaphragm and local compensatory emphysema.

The abnormal shadows in the upper zones (30·5%) in many cases bore a great resemblance to those of pulmonary tuberculosis. In twenty-six cases (37·6%) there was some residual increased density and size of the striations after the shadow had cleared.

Illustrations of a representative selection of these radiographs are provided.

## Discussion

It would be of interest to investigate the total incidence of minor respiratory infections in the community and the proportion with radiographic abnormalities, such as have been described, and to follow up such a series. In another series of young male adults examined by mass radiography there was an incidence of 0·17% of such abnormal radiographic shadows (Trail, 1944). However, it would seem probable that this incidence would be greater in children, elderly and debilitated persons, and in those with chronic pulmonary disease. It has been estimated that an average of one in eight persons develops a " cold " during a month (Stocks, 1949). Figures quoted by different writers for the attack rate of respiratory infections mostly concern outbreaks in closed communities such as military camps and schools, and include only those who actually report sick (Gallagher, 1934; Bowen, 1935; Daniels, 1942). In one such community 50% had a respiratory infection during two months, and 6% of these had radiographic appearances of pneumonia (Reimann and Havens, 1940).

In the present series, abnormal physical signs were found in 44·9% on initial examination. In many cases these consisted solely of a small area of absent or decreased breath sounds, crepitations, or slight dullness. Radiography

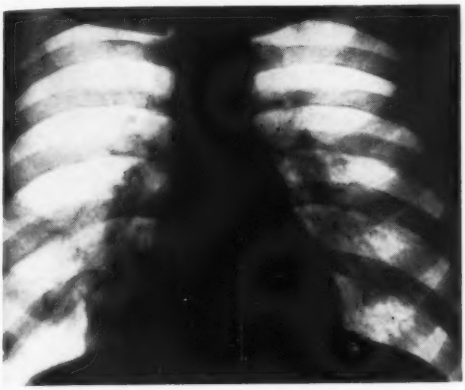

FIG. 1.—RADIOGRAPH SHOWING OPACITY AND COMPENSATORY EMPHYSEMA IN RIGHT CARDIO-PHRENIC ANGLE. COLD AND COUGH FOR TWO WEEKS. DULLNESS AND DECREASED BREATH SOUNDS AT RIGHT BASE. RECOVERY, WITH OPACITY CLEARED, FOUR WEEKS LATER.

FIG. 2.—RADIOGRAPH OF LEFT APEX (TILTED ANTERIOR-POSTERIOR) SHOWING OPACITY ADJOINING MEDIASTINUM. NO ABNORMAL SIGNS OR SYMPTOMS; COLD AND COUGH STARTED FOUR DAYS *AFTER* EXAMINATION AND RECOVERED, WITH OPACITY CLEARED, TWO WEEKS LATER. (THIS CASE WOULD HAVE BEEN MISSED IF ANTERIOR-POSTERIOR VIEWS HAD NOT BEEN USED AS ADDITIONAL ROUTINE BY MASS RADIOGRAPHY UNIT).

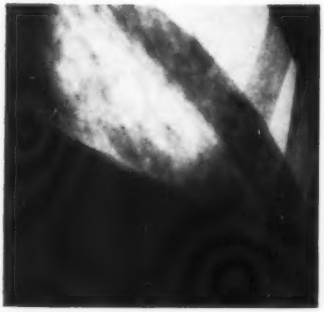

FIG. 3.—RADIOGRAPH OF LEFT LOWER ZONE SHOWING OPACITY, WITH DENSER AREA WITHIN IT, THICKENED STRIATIONS AND COMPENSATORY EMPHYSEMA. COUGH AND COLD FOR TWO WEEKS. CREPITATIONS AT LEFT BASE. RECOVERY WITH LUNG CLEARED, FOUR WEEKS LATER.

FIG. 4.—RADIOGRAPH OF RIGHT LOWER ZONE (ANTERIOR-POSTERIOR) SHOWING OPACITY. COLD FOR THREE DAYS. NO COUGH. CREPITATIONS AT RIGHT BASE. RECOVERY, WITH OPACITY CLEARED BUT WITH RESIDUAL THICKENED STRIATIONS, THREE WEEKS LATER.

*To face p. 18*

## PLATE IV.

FIG. 5.—RADIOGRAPH OF RIGHT LOWER ZONE SHOWING OPACITY. COUGH AND COLD FOR FOUR WEEKS. RHONCHI AT RIGHT BASE. RECOVERY, WITH OPACITY CLEARED, FOUR WEEKS LATER.

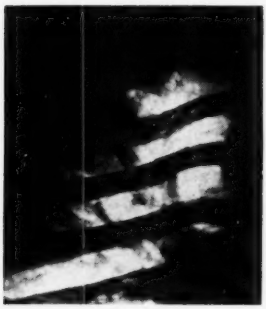

FIG. 6.—RADIOGRAPH OF LEFT APEX (ANTERIOR-POSTERIOR) SHOWING OPACITY. COLD AND COUGH FOR FOUR WEEKS. NO ABNORMAL SIGNS IN CHEST. RECOVERY, WITH OPACITY CLEARED, TWO WEEKS LATER. SUBJECT TO BRONCHITIS.

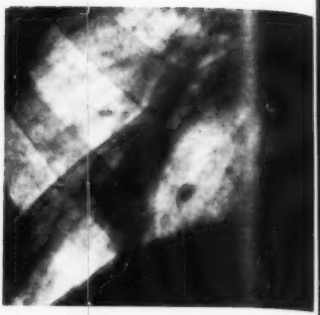

FIG. 7.—RADIOGRAPH OF RIGHT LOWER ZONE SHOWING OPACITY, THICKENED STRIATIONS AND COMPENSATORY EMPHYSEMA. COLD AND COUGH FOR FOUR DAYS. DECREASED BREATH SOUNDS AND CREPITATIONS AT RIGHT BASE. RECOVERY, WITH OPACITY CLEARED BUT WITH RESIDUAL THICKENED STRIATIONS, THREE WEEKS LATER.

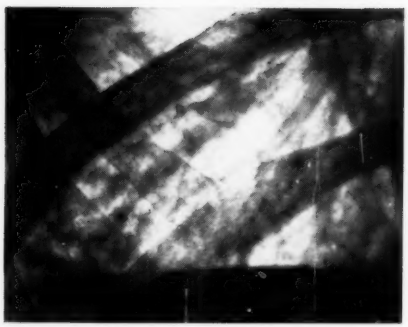

FIG. 8.—RADIOGRAPH OF RIGHT LOWER ZONE SHOWING OPACITY, THICKENED STRIATIONS AND BACKGROUND OF COMPENSATORY EMPHYSEMA. COLD AND COUGH FOR TWO WEEKS, RHONCHI AT RIGHT BASE. RECOVERY, WITH LUNG CLEARED FOUR WEEKS LATER. SUBJECT TO ASTHMA.

FIG. 9.—RADIOGRAPH OF RIGHT LOWER ZONE SHOWING OPACITY AND COMPENSATORY EMPHYSEMA. COUGH AND COLD FOR TWO WEEKS. RHONCHI AND CREPITATIONS AT RIGHT BASE. RECOVERY, WITH OPACITY CLEARED BUT WITH RESIDUAL THICKENED STRIATIONS, FOUR WEEKS LATER. SUBJECT TO FREQUENT BRONCHITIS.

FIG. 10.—RADIOGRAPH OF LEFT MIDDLE ZONE SHOWING OPACITY AND THICKENED STRIATIONS. NO ABNORMAL SIGNS OR SYMPTOMS; COLD AND COUGH STARTED FIVE DAY *AFTER* EXAMINATION AND RECOVERED, WITH LUNGS CLEARED, THREE WEEKS LATER.

*To face p.*

is now tending to replace rather than supplement physical examination of the lungs, but it may not always be possible to perform a radiographic examination of these mild cases, so that a high degree of accuracy in the clinical examination of the chest appears to be still necessary.

Collapse of the lung, and mild infection owing to aspiration of material into the lower air passages have been considered to be causes of many cases of this type (Ramsay and Scadding, 1939). Collapse has been considered to be a frequent cause of transient shadows which appear in the course of upper respiratory infections, bronchitis and asthma (Jeanneret and Famé, 1933; Miller *et al.*, 1935; Snow and Cassasa, 1937; Andrus, 1942; Becker, 1943). A frequent association has been found between infection of the nasal sinuses, and infection, with collapse, of the lungs (Kennedy, 1943; Paton Philip, 1948). The physical signs of a small area of pulmonary collapse would be just those which have been described in many of the cases of this series; the intensity of certain signs, such as dullness, may even be lessened by the presence of associated compensatory emphysema.

In this series there is evidence of pulmonary collapse in a number of radiographs, shown by compensatory emphysema associated with the shadows, and convergence of striations, and many of the remainder of the abnormal shadows are not incompatible with collapse. It has been thought by some writers that permanent lung damage such as bronchiectasis may result from the pulmonary collapse which may occur in these cases (Anspach, 1934; Andrus, 1942; Becker, 1943; Kay, 1945). It seems possible, therefore, that the type of case described here, especially if undiagnosed, may contribute to the natural history of permanent lung damage by initiating and continuing a vicious circle of respiratory illness. Apart from the medium of collapse, it is possible that these apparently minor respiratory infections may cause an increasing degree of susceptibility towards further such infections.

It would be expected that if these conjectures are right such cases would have a greater history of respiratory illness than other persons. Eleven (52·3%) of twenty-one cases of aspiration pneumonia gave a previous history of pneumonia, pleurisy or chronic bronchitis (Ramsay and Scadding, 1939). In a series of cases of pneumonia caused by bacteria other than pneumococci there was a previous history of pneumonia or chronic bronchitis in 48% (Humphrey *et al.*, 1948). In the present series, with a standard of fitness higher than average, 30·5% said they had previously suffered from pneumonia, severe influenza, hay fever and asthma, or were especially subject to coughs and colds.

In many of these cases residual increase in size and density of pulmonary striations persisted in radiographs after other evidence of infection had disappeared, and many other radiographs were seen in which this was the only abnormality. These may have represented the residual stages of previous infection, acute or chronic tracheo-bronchitis (Kornblum and Reimann, 1940), or the initial stages of an infection. The thickened, inflamed bronchial walls may predispose to collapse. These appearances may form a connecting link between previous infection and permanent damage.

Differentiation of radiographic appearances of pulmonary tuberculosis from those of this type of respiratory infection is a problem. Erroneous diagnoses have been made (Kneeland and Smetana, 1940). The duration of these cases

was not more than about eight weeks so that observation for this period seems all that can be done, with negative sputum, but it is an anxious time for the patient. The recent history and the presence of respiratory catarrh are of some assistance (Drew *et al.*, 1943).

In three patients symptoms appeared from two to five days *after* their radiographs had revealed an abnormal shadow; such a discrepancy might upset the calculation of the incubation period in experimental and other groups. The occurrence of symptomless cases, two in this series, may cause error in estimating the incidence of infections in epidemics.

The problem of nomenclature has become difficult. The respiratory tract is a single unit of which the whole or any part may be involved, either by the primary infection or by secondary infection or collapse. Such infections may be incidents in a more generalised illness. Radiographic abnormalities may or may not be present and may not bear any relation to the severity of the infection. Terms such as " cold," " coryza," " upper respiratory infection," may be inaccurate and deceptive. " Pneumonia " was originally used for serious inflammation of the lungs and seems unsuitable for this type of case. It is difficult to explain to a patient that he has " pneumonia " when he is feeling well and almost symptom free; if he sees " pneumonia " on his sickness certificate he may disbelieve it, or, according to the dictates of his conscience, be pleased to have an apparently sound reason to exaggerate his symptoms and extend his sick leave. A name which refers to the respiratory tract as a whole and which may be qualified by the causal organism, if known, seems to be required; " pneumonia " could be added in the more severe cases. As regards etiological factors, it has been found difficult to assess the significance of organisms cultured from sputum specimens; growth on culture media does not necessarily reflect the relative proportion of each species in the inoculum (Commission, 1948). In any case, the flora of sputum are not necessarily the same as obtained from local areas of the lungs by bronchoscopy (Neuhof and Thomas, 1945).

Treatment of this type of case is important to prevent residual damage. Measures which may help include prevention of dehydration, which may predispose to viscid mucus and collapse, by avoidance of diaphoretic medicines or their supplementation by adequate fluids; sedatives which depress the cough reflex should be avoided in excess. The treatment of persistent upper respiratory infection is important. Breathing exercises are a most important form of treatment to prevent these infections and, when they have occurred, to prevent residual damage. Their routine use in all such respiratory infections might be very beneficial. In children, training in such exercises, apart from preventing bad breathing habits, may help to prevent much future damage of the lungs.

## Summary

The incidence of abnormal radiographic shadows associated with mild respiratory infections in a series of young male adults examined by mass radiography was 1·8 per thousand. This may be greater in children, elderly persons and in those with established lung damage.

The full extent of the involvement of the respiratory tract in these infections probably remains undisclosed unless routine examinations are carried out.

The proportion of these cases with abnormal physical signs in the lungs was 44·9%.

The abnormal radiographic appearances are described; a number are indicative of small areas of collapse of the lung.

It is suggested that permanent damage of the lungs may result from this type of case, especially if undiagnosed, and a vicious circle created.

Some problems of nomenclature are discussed.

Treatment of this type of case is important to prevent residual damage of the lungs. Some measures considered include the avoidance of dehydration and the use of breathing exercises.

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# CONJUGAL TUBERCULOSIS AND ITS BEARING ON THE ETIOLOGY OF THE DISEASE

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Twenty-five years ago medical students were commonly taught that the spouse of a sufferer from pulmonary tuberculosis was exposed to no greater risk than the spouse of a healthy person, and, from conversations with workers in tuberculosis, this idea seems still prevalent. It assumes that close contact with the disease does not cause it to develop in the spouse at risk, an argument against the significance of exogenous infections in the etiology of adult pulmonary tuberculosis. Certainly, contacts of all age groups show an abnormally high incidence of the disease, perhaps partially explained by frequent blood relationship to the infecting case and, therefore, sharing his or her congenital lack of resistance.

There are already a number of contributions to the literature of conjugal tuberculosis. Paterson (1940) analysed a series of white and negro cases attending a dispensary in the U.S.A. from 1928 to 1938, and found that of 322 consorts of tuberculous patients 25 developed the disease (7·8 per cent.). He compared these figures with the local incidence of the disease and concluded that the mortality from tuberculosis of wives of tuberculous husbands was significantly higher than would be expected. The mortality of men whose wives had the disease was also higher than expected, though not of statistical significance. Spector (1939) has made similar observations in St. Louis, U.S.A., on 5,514 married cases of pulmonary tuberculosis observed from 1928 to 1939, and found that of these 210 couples both had the disease. He concluded that the risk to a consort whose spouse had tuberculosis was twenty-nine times greater than in the general population. Spector regarded these facts as favouring the importance of exogenous reinfection in the etiology of adult tuberculosis, but the conclusions are open to criticism, since the tuberculosis incidence in the general population may not be a measure of incidence in the married. Minning (1927), also in the U.S.A., investigated 1,888 married or widowed cases of tuberculosis and found that 319 (16·8 per cent.) had tuberculous consorts. He also found a higher incidence of the disease in widows than widowers, and considered these figures striking enough to favour a belief in exogenous reinfection.

In this country Maurice Davidson (1932) reviewed the literature of marital tuberculosis, and concluded that if one of the partners had advanced disease the risk of exogenous reinfection to the spouse would be greater than normal. He quotes Verco's work, undertaken in Australia so far back as 1911, which reported that 40 per cent. of widows of phthisical men and 11 per cent. of phthisical widowers died of pulmonary tuberculosis—this is undoubtedly a striking incidence, but it may be questioned whether standards of diagnosis at that time entirely justified these high figures.

McDougall (1949) discusses conjugal tuberculosis in his book and quotes the work of Wolff and Ciocea (1942) in U.S.A., and of Tular and Parrugue

(1945) in France. The conclusions reached by these authors affirmed an increased incidence of tuberculosis in the spouses of tuberculous patients. Struthers (1930) gave a detailed account of 14 cases of tuberculosis affecting both spouses, and from an analysis of the family histories of these couples, and of the adverse physical factors affecting them at the time, concluded that there was little or no evidence that they infected each other. Struthers also quotes previous workers whose conclusions were similar to his, although in the absence of radiological confirmation the accuracy of the diagnosis is questionable.

The balance of evidence from these figures favours the view that the spouses of tuberculous patients do, in fact, themselves develop the disease to a greater extent than in the normal population. Difficulties in reaching a definite conclusion include the following: (1) It appears to be established as a broad general rule that " like tends to marry like " (Pearson and Elderton, 1909), and consequently the spouses of tuberculous patients may themselves have a congenital lack of resistance to the disease. (2) The secondarily affected spouse may have acquired the disease from some extra-marital source. (3) It is well known that treating patients of both sexes in sanatoria results, despite the vigilance of the authorities, in a certain proportion of marriages between persons already both suffering from tuberculosis, although, in any large series of cases, these are unlikely to represent more than a very small percentage. (4) When a case of tuberculosis occurs in a marriage, and particularly when the wage earner is affected, the economic circumstances of the family deteriorate. In this country, however, the operation of schemes for the financial assistance of such families tends to offset this factor.

The present investigation was undertaken on a more recent series of cases in this country, to discover whether any further light could be thrown on this important problem.

The admissions to St. George's Home, Chelsea, for the years 1940-9 inclusive have been analysed. This hospital receives adult female cases of pulmonary tuberculosis for assessment and treatment, sent from the chest clinics in the L.C.C. area (since 1948, from the South-west Metropolitan Region). During this period 835 married or widowed patients have been admitted, and of these 68 (8·1 per cent.) had husbands who had been diagnosed as tuberculous.

The age grouping of the wives was as follows:

| *Age* | *No.* |
|---|---|
| Under 20 | 0 |
| 20–29 | 21 |
| 30–39 | 22 |
| 40–49 | 18 |
| 50–59 | 4 |
| 60–69 | 3 |
| | 68 |

Of these 68 patients, no fewer than 36 were widows whose husbands had already died of pulmonary tuberculosis. In 12 cases the husband had died during the previous year, and in 6 during the previous three years. In the remaining cases the date of the husband's death was not established. The

figure of 8·1 per cent. here observed agrees closely with that of Paterson (7·8 per cent.) already quoted. In attempting to decide whether this incidence of pulmonary tuberculosis in the husbands of tuberculous wives is abnormal, a comparison should be made with the incidence in the male partner in marriages in general. Although this is not known by the Registrar-General, certain approximations may be made which can assist in the comparison. The number of married couples in 1940-9 was approximately 10,000,000, and an incidence of tuberculosis of 8 per cent. in married males would produce 800,000 single cases, although experience shows that this far exceeds the actual number. The comparison may be also made from another angle. In 1948 a total of 4,041 married women died of tuberculosis, a figure which must bear a relationship to the total number of tuberculous married women. This ratio will vary to some extent from area to area, depending partly on the efficiency of diagnosis in that area and partly in the recovery rate. Thus, where standards of investigation and diagnosis are high there will be a greater proportion of diagnosed cases to deaths than in a less efficient area. At Edgware Chest Clinic, where standards can be regarded as good, for the years 1944-9 there was an average of 754 adult women on the register with 37 average annual deaths. Assuming that married women have the same death rate as unmarried, and that the ratio observed at Edgware holds for the rest of England and Wales, 4,041 actual deaths of married women corresponds to 82,000 cases of tuberculosis in married women. As the standard throughout the country was likely to be lower, the actual number of cases is probably in fact lower than 80,000. An 8 per cent. incidence of pulmonary tuberculosis in married women would produce some 800,000 cases—a figure again very considerably in excess of the actual number. This approximation has been made for married women because the deaths from tuberculosis in married men are unknown to the Registrar General, although the 8 per cent. incidence does in this investigation relate to men. Even so the results seem to indicate an abnormally high incidence of tuberculosis in the husbands of tuberculous wives in this series.

It is of some interest to ascertain which was the initial case of pulmonary tuberculosis in these 68 marriages. In 36 of them the husband had already died of the disease, and closer investigation confirms that in the majority of these he was most probably the initial case. In the remaining 32 marriages, it appeared that the husband was the initial case in 9, and the wife in only 3. In the remaining 20 cases no conclusion on this point could be reached owing to lack of information. One of these initial female cases, who on admission had extensive bilateral disease, stated that a fiancé had died of tuberculosis some years previously, and her husband had died of the disease recently.

No doubt the incidence of conjugal tuberculosis could be reduced by the use in the home of the ordinary precautions against infection, taught in sanatoria. Here the chest clinics, and particularly the health visitors, have an important part to play, but ultimately the success of their efforts must depend on the intelligence and co-operation of the couples concerned, and not least on their housing conditions. Probably the greatest danger period to the spouse is during the period, long or short, which elapses before the diagnosis of tuberculosis is made. The marked improvement in the " sputum conversion " rate attained in some sanatoria in the past few years, as a result of chemotherapy,

and advances in surgical technique, will exert a favourable influence in reducing marital as other cases. However, the problem is perhaps of greater interest from its theoretical bearing on the etiology of adult tuberculosis, and an attempt must be made to fit these observations, if accepted, into the general framework of the theories relating to the causation of adult disease.

Briefly, the factors to be considered are: (1) congenital resistance, (2) acquired resistance, (3) exogenous re-infection, (4) endogenous re-infection. (We are not here concerned with the progressive primary case, which is, however, likely to become increasingly important in young adult life.) By endogenous re-infection is meant the reawakening of an infection (primary infection) which has been long dormant in the body, presumably precipitated by some environmental factor or factors. The use of the term " re-infection " in this sense, where there has, in fact, been no new entry of bacilli from without, seems to be a misnomer, but has come into general usage; the term " endogenous recrudescence " would seem more self-explanatory.

The relative importance of these factors is unknown, but the facts observed in this and other surveys quoted suggest that exogenous re-infection is an important factor in some cases of adult tuberculosis.

The problem must also be viewed from another angle. This survey has shown that 92 per cent. of the husbands of tuberculous patients do *not* themselves have the disease. We cannot suppose that this is commonly because they are not infected, but must be due to a high congenital or acquired resistance and/or to favourable environmental conditions. This fact focuses attention on the relative importance of congenital resistance and infection in the development of the disease. The subject, as shown by the recent debate of the British Tuberculosis Association (on the importance of infection or otherwise), has stout advocates on either side. But it is interesting to remember that the controversy is not new. Benjamin Marten (quoted by Lyle Cummins) so far back as 1720 writes, " The Original and Essential Cause, [of phthisis] then, which some consent to call a vicious Disposition of the Juices, others a Salt Acrimony, others a strange Ferment, others a Malignant Humour . . . may possibly be some species of Animalculæ or wonderfully minuted living creatures . . . capable of subsisting in our juices and vessels." And on the present subject Marten writes: " It may therefore, be very likely that by habitual lying in the same Bed with a consumptive Patient, constantly eating and drinking with him or by very frequently conversing so nearly as to draw in part of the breath he emits from the Lungs, a Consumption may be caught by a sound person." These views were, of course, soon forgotten, but it seems reasonable to believe that both these factors, congenital resistance and infection, play major parts in the etiology, parts which may vary greatly in importance from one individual to another. But as infection at the present time in this country is ultimately universal, there can be no doubt that congenital and/or acquired resistance, and environmental influences, are the deciding factors in preventing the development of disease in the majority of the population. From a practical point of view, however, in our efforts to eradicate tuberculosis we are unable either to alter or measure the degree of congenital resistance—we may infer a degree of resistance or lack of it from the family history, but fortunately we have not yet a Whitehall-controlled Department of Genetics

which arranges our marriages. We are able to improve acquired resistance in the tuberculin negative only, by the injection of B.C.G., and in the tuberculin-positive probably by improving nutrition and other environmental factors.

It is sometimes argued that tuberculosis is not an infectious disease, because in its behaviour, and particularly in its chronicity and its allergic phenomena, it is so unlike the common exanthems. The fact remains, however, that without infection with the bacillus, tuberculosis does not occur. Our aim for the future must be the total elimination of the disease by combined clinical and public health measures which will secure a tuberculin-negative, tubercle-free population—a fact already well recognised and approaching achievement in certain parts of the U.S.A.

## Summary

1. Literature relating to conjugal tuberculosis has been reviewed.

2. An analysis of 825 married women with pulmonary tuberculosis has been made.

3. Sixty-eight of these women had husbands who had suffered or were suffering from tuberculosis.

4. Of the 68 husbands, 36 had already died of pulmonary tuberculosis.

5. Approximations suggest that there was an abnormally high incidence of tuberculosis in both partners in these marriages.

6. The bearing of these findings on the etiology of adult pulmonary tuberculosis is briefly discussed.

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# THE CHANGING PATTERN OF PNEUMONIA

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The anatomical classification of pneumonia was generally accepted until about ten years ago. Text-books of medicine devoted twenty or thirty pages to lobar pneumonia, five or six to bronchopneumonia, and gave a few lines or a page or two to the description of other varieties. Before the days of chemotherapy lobar pneumonia was a clear-cut entity, running a course which could largely be predicted, having many serious complications, chief among which was empyema, and carrying a heavy mortality. Looking back, it seems that the pattern had already begun to change before the advent of sulphonamides, although until that time the change was gradual; but since the advent of chemotherapy the picture of pneumonia in hospital has become so different as to be unrecognisable from the old textbook descriptions.

I have traced the records of 109 cases of "pneumonia" which have come under my observation since April, 1948, and have made the following classification of them:

| | |
|---|---|
| Lobar pneumonia | 7 |
| Bronchopneumonia | 11 |
| Post-operative hypostatic pneumonia | 9 |
| Atypical pneumonia with lobar consolidation | 37 |
| Atypical pneumonia with lobular consolidation | 45 |
| Total | 109 |

It seems inescapable that much of the change in the pattern of pneumonia must be attributed to the effect of chemotherapy. Of the three methods of diagnosis by symptoms, signs and X-rays, the first is no doubt the easiest in practice. The onset of a febrile illness associated with cough, dyspnœa and perhaps chest pain is nowadays a signal for the use of sulphonamides and/or penicillin. Some of these cases are true incipient bacterial pneumonia, but the exact diagnosis does not matter either to doctor or patient so long as recovery is rapid. If the usual precautions are observed and the patient does not exhibit any unfortunate idiosyncrasy to the drug used, little harm results from such indiscriminate chemotherapy, which provides a therapeutic test of no small value. Some cases, however, run a progressive course unaffected by such treatment, and it is a constant source of wonder how often chemotherapy is continued long after any chance of a specific response has passed. In general terms, it may be said that chemotherapy will render a patient with pneumococcal pneumonia afebrile in three days if it is likely to have any effect at all. In hospital practice, with rare exceptions, it is only those patients who have not responded to this initial chemotherapy who are admitted for further investigation and treatment.

By the time admission is arranged the symptoms point clearly to pulmonary disease, and often enough physical signs are present which give at least a rough localisation. The chest skiagram will complete the clinical picture, and,

although there is no single constant pattern, the appearance should always confirm the pneumonic nature of the condition.

From the foregoing it is clear that pneumonia as it is now seen in hospital is, with the rarest exceptions, resistant both to sulphonamides and to penicillin. Whenever possible the bacteriology of the sputum should at once be investigated and a leucocyte and differential count undertaken. The great majority show no specific predominant organism and a normal or near-normal leucocyte count. To these the term " primary atypical pneumonia " has been applied.

### Primary Atypical or Virus Pneumonia

These two names are practically synonymous, although positive proof of virus etiology is rarely obtained.

It would not be profitable to discuss whether virus pneumonia is a new entity, whether it occurs more frequently than of old, or whether it is only diagnosed more often. As seen in hospital practice its manifestations are pleomorphic, the onset is often, although not always, insidious, and the course is largely unpredictable. Fever is moderate, as also is the cough; sputum is small in amount and rarely blood-stained; while early pleural involvement is much less common than in bacterial pneumonia. The febrile onset with malaise often precedes any pulmonary physical signs by several days and is similar to any febrile catarrh, while the occasional case with abdominal pain due to diaphragmatic pleurisy is still sometimes confused with an acute abdominal emergency. The association of a transient jaundice with the initial phase is not uncommon and may indicate that the infecting agent can be facultatively pneumotropic or hepatotropic, but eventually chooses the " locus minoris resistentiæ." Such tropism would conform to the well-known behaviour of some viruses of the acute specific fevers.

Once localisation in the lung has occurred, the further course seems unpredictable. With fever, absence of substantial leucocytosis, lack of response to ordinary chemotherapy, a positive cold agglutinin reaction and significant radiological changes, the diagnosis may not be difficult, but the full clinical and pathological picture is not always found. Physical signs may be absent or minimal in the early stages, and without an X-ray the extent of the lesion may be unsuspected. The course of the untreated infection may vary from a few days to several months; a fulminant onset may be followed by repeated migrations and relapses or by recovery in a short period, so that it is rarely possible to be certain that improvement, when it occurs, is likely to be permanent. Aureomycin is the only remedy which has any great reputation in the treatment of this condition, but the variable clinical course makes its assessment difficult. Chloromycetin has not been used to any great extent in this country so far. It is possible that primary atypical pneumonia may result from infection with any one of several viruses, only some of which are aureomycin sensitive, and this would explain the varying response reported by different workers. In view of its great expense it seems right to reserve aureomycin for patients who are seriously ill and whose illness may be greatly shortened by its use, but it is well to recognise that virus pneumonia has scarcely any mortality except in the old and debilitated. In the author's personal experience the only

## PLATE V.

FIG. 1.—SHOWING COLLAPSE OF THE LEFT LOWER LOBE (P.A. VIEW).

FIG. 2.—VIRUS PNEUMONIA. FILM SHOWING THE BRONCHOPNEUMONIC DISTRIBUTION.

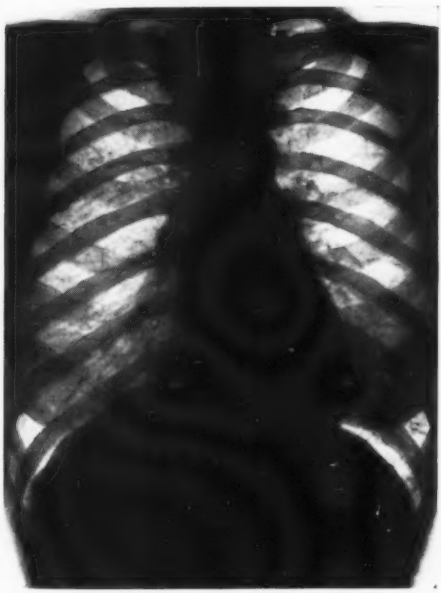

FIG. 3.—SAME CASE AS FIG. 2 SHOWING COMPLETE RESOLUTION AFTER THE ADMINISTRATION OF AUREOMYCIN.

FIG. 4.—VIRUS PNEUMONIA, SHOWING THE MIGRATING AND RELAPSING TYPE (NOTE THE LESION IN THE LEFT LOWER ZONE).

*To face p. 28*

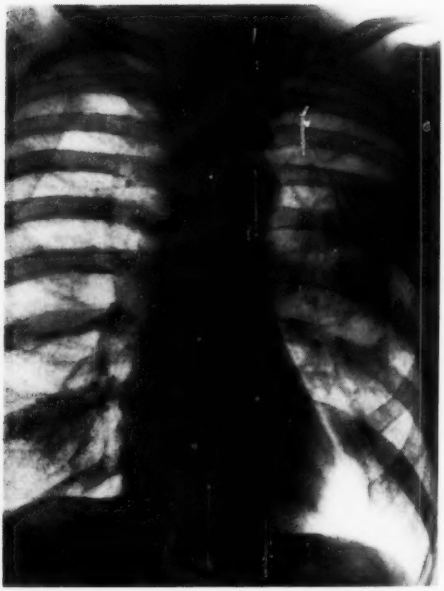

FIG. 5.—SAME CASE AS FIG. 4. NOTE THE MIGRATION TO THE LEFT MID-ZONE WITH EVIDENCE OF EXCAVATION.

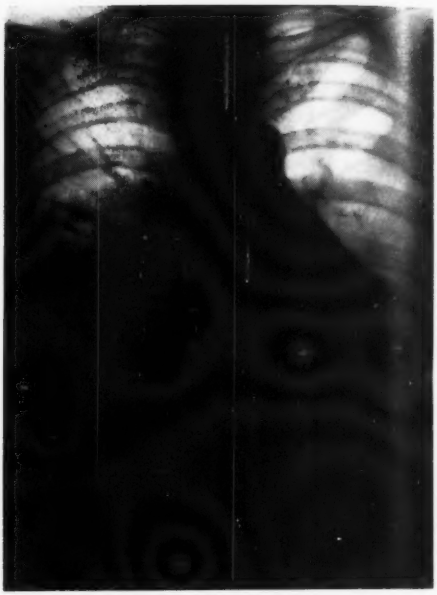

FIG. 6.—CASE OF VIRUS PNEUMONIA.

FIG. 7.—SAME CASE AS FIG. 6 WITH APPARENT RESOLUTION.

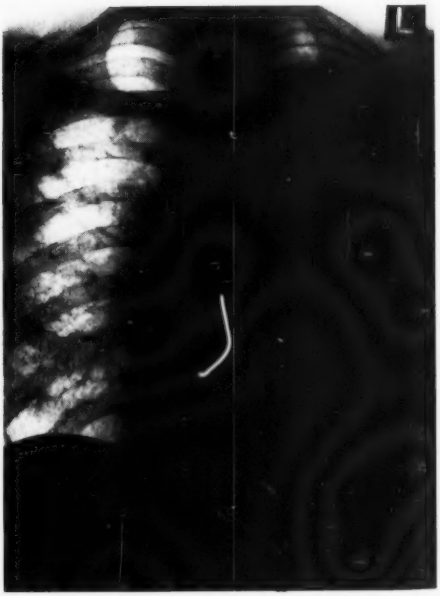

FIG. 8.—SAME CASE AS FIG. 6 FOLLOWING RELAPSE (P.A. VIEW).

*To face p. 29*

death was the very sudden exodus of a diabetic who, so far as his pneumonia was concerned, was already convalescent.

Four clinical types of atypical pneumonia may be recognised, and all of them are associated with varying degrees and distribution of atelectasis. The mildest forms are segmental, giving fluffy radiological infiltration, sometimes difficult to distinguish from tuberculosis on appearance. These cases have few physical signs, but often rhonchi and crepitations are heard over the affected area, and these may persist after the radiological abnormality has begun to resolve. The more severe forms give lobar collapse and consolidation, often well-defined and persistent. These are fairly common and easily recognised. The delay in resolution in these cases may extend to many months. Fig. 1 is from a patient with collapse of the left lower lobe which persisted for more than two months and proved resistant to all forms of chemotherapy, including aureomycin. Recovery began after bronchoscopic aspiration of the lower lobe bronchi. Bronchopneumonic distribution is less common, but may be associated with severe physical prostration. Fig. 2 is taken from the film of a woman of 36 who appeared acutely ill when first seen, and the bronchopneumonic distribution raised serious doubts as to whether this were not perhaps of tuberculous etiology. All the pathological investigations, however, confirmed the diagnosis of virus pneumonia, including a cold agglutinin titre of 1 : 2048. Her recovery started with the administration of aureomycin, and Fig. 3 shows the condition after recovery. The fourth clinical group consists of the migrating and relapsing cases. Figs. 4 and 5 are from a patient in this group, showing the original lesion in the left lower zone and the subsequent migration to the left mid-zone. Such cases may be distinguished from the relapsing type, since their illness, which may be either mild or severe, is nevertheless continuous. In the present series several cases of migrating type have presented with opacities which at first sight suggested neoplasm, but the subsequent migration has settled the problem. Many of these patients remained ambulant throughout their illness. Occasional cases, however, justify bronchoscopy on the original suspicion. Figs. 6, 7 and 8 illustrate relapse. Fig. 6 was taken during the original illness, Fig. 7 after apparent recovery, and Fig. 8 during relapse. Migration and relapse appear to be little, if at all, affected by aureomycin, and remote occurrence of relapse may, in fact, be new exogenous infection.

Polymorphonuclear pleural effusion frequently accompanies the lung lesions of virus pneumonia, but rarely, if ever, becomes a true empyema. The effusions are not large, but if clinically recognised should be aspirated to prevent subsequent pleurogenic fibrosis. A very rare but important complication of virus pneumonia is lung abscess. It is presumably due to secondary bacterial infection of the devitalised atelectatic area, and may be either acute, virulent and toxic, or chronic and almost symptomless. The latter cases raise great diagnostic difficulties and cause much needless worry, being frequently confused with tuberculosis. Chronic excavation of this kind is often symptomless and is actually shown in Fig. 5.

Finally, it should be noted that elevation of the sedimentation rate persists long after clinical recovery is complete and may often have to be ignored in the clinical assessment of the patient's condition.

### Hypostatic Pneumonia

This is seen most often as a post-operative complication. The modern practice of employing breathing exercises and early mobilisation after major surgical procedures has done much to prevent stasis and consequent plugging of bronchi with mucus. There were, however, nine cases among those reviewed for this paper, and no doubt more occurred in the surgical wards in the same period for whom the advice of a physician was not sought. In this condition lobar collapse is due to mechanical obstruction of a main bronchus, and subsequent secondary infection leads to fever. Although chemotherapy has a certain value in these cases, the main emphasis in treatment should be placed on encouraging forced coughing, postural drainage with the collapsed lobe uppermost, and firm percussion therapy. Re-aeration, re-expansion and defervescence of fever follow the institution of these therapeutic measures with remarkable certainty and rapidity. Where pain interferes with coughing the use of intravenous procaine has been advocated, but I have no personal experience of this.

### Other Pneumonic Infections

Recently two cases of pneumonia due to infection with pneumo-bacillus of Friedländer have come under my care. In addition to rather persistent lobar consolidation both had a fair amount of hæmoptysis and both eventually responded to streptomycin, 2 grammes daily. Nataro *et alia* (1950) have recently reported five cases due to Friedländer's bacillus and have summarised ten others from the literature. Their experience shows that streptomycin is the most effective antibiotic, and on the basis of one case they believe that aureomycin may also be very valuable. In neither of my cases did aureomycin produce any noticeable response after four days of treatment with 1 gramme daily.

It seems certain that careful bacteriological investigation together with a slight hesitancy in the use of chemotherapy would reveal a considerable number of infections with the less common bacteria. Most patients with pneumonia are treated in their own homes and respond to chemotherapy, so that the cases which are fully investigated do not represent a fair cross-section of the problem.

The staphylococcal and streptococcal pneumonias have always been rare in their pure forms, but chemotherapy has contributed very largely towards making of them clinical curiosities. No example was encountered in the present series.

Coccal pneumonia formerly occurred as a complication of influenza, and might assume some importance should another epidemic of the latter disease arise.

Small series of cases of staphylococcal pneumonia have been reported in the literature (Boyette, 1948). They show a sudden onset with rigor, fever, rapid respiration and cough, but an insidious onset has also been reported. Severe dyspnœa with purulent and often blood-stained sputum are notable features. Before the era of chemotherapy pyo-pneumothorax was a frequent complication, but this stage is now rarely reached, since the response to sulphonamides and antibiotics is satisfactory and very rapid.

Streptococcal pneumonia sometimes occurs as a sequel to sore throat, tonsillitis, or other upper respiratory infection. It was also an important cause of mortality during the influenza epidemics. The fulminant onset, leading in a few hours to an inflammatory pulmonary œdema with pink and frothy sputum and heliotrope cyanosis, produced a clinical picture which those who have once seen it will never forget. The organism is highly sensitive to penicillin, and its rapid response makes the fully developed condition very uncommon nowadays.

The relationship of the bacterial pneumonias to influenzal and other virus infections of the lung has given rise to much speculation; some authorities believe that a virus is often, if not always, responsible for the primary lung lesion and that a bacterial infection is superimposed. Arguing from this hypothesis, they believe that the bacterial element is generally overcome by chemotherapy and that the virus disease is thereby unmasked. For various reasons it seems improbable that this theory is correct, but it can neither be proved nor disproved on present evidence.

### "Unresolved Pneumonia"

In former years this was in itself an acceptable diagnosis. Today it is recognised that virus and Friedländer pneumonia may both show much delay in resolution; this does not constitute a separate entity, but rather a variant of the clinical pattern. Caution must be exercised when an apparent pneumonia of doubtful etiology runs a prolonged course. Bronchial carcinoma may show itself first when secondary infection occurs beyond a bronchial obstruction, but such infection may respond, for the time being at least, to chemotherapy. Subsequent relapse may again be wrongly interpreted, and the chance of employing radical therapeutic measures may be lost. In any case of doubt bronchoscopy is justified, although peripheral tumours may even then be beyond the range of vision.

## Conclusion

The bacterial pneumonias in their classical and developed forms are now rarely seen either in hospital or private practice. It seems that they are aborted in their very early stages by chemotherapy. "Primary atypical pneumonia" has largely taken their place, but the clinical picture of this is not yet complete, and it may be assumed that the virus or viruses are still increasing in virulence. Each patient must be separately studied, and the etiological classification so well championed by Scadding (1946) undoubtedly furnishes the right approach to the diagnosis of pneumonia. The pattern of lung infections has changed in a generation and is still changing rapidly. No dogmatic description can be given, and a fresh clinical picture presents itself with alarming frequency. It is perhaps permissible to look back nostalgically to the days when lobar and bronchopneumonia were the only diagnostic groups and the small residuum could conveniently be dubbed "unresolved."

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Boyette, D. P. (1948): *North Carolina med. J.*, **9**, 200.
Nataro, M., Shapiro, D., and Gordon, A. T. (1950): *J. Amer. Med. Ass.*, **144**, 1, 12.
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# OBITUARY

## DR. S. ROODHOUSE GLOYNE

ALL branches of thoracic medicine suffered a grievous loss on the death of Dr. S. Roodhouse Gloyne, which occurred in London during September 1950. He qualified in Leeds, but for the greater part of his professional life, from 1911 to 1947, he was pathologist to the London Chest Hospital. For this hospital he had a very great and lasting affection and was very happy in its service. He was an authority on its history, buildings and the early members of its medical staff.

Beginning in a single room, his department was expanded into a separate block of laboratories which was built to his design and opened in 1928. During his hospital career he was closely associated with the major developments in the diagnosis and treatment of pulmonary tuberculosis and other thoracic conditions. With his acute powers of observation and critical judgment he was properly recognised as the authority in this branch of pathology. It was therefore even more regrettable that his department with all his records and specimens was completely destroyed by enemy action in 1941.

Dr. Gloyne had great breadth of vision. He saw the whole problem and considered it, rather than the details. During his careful laboratory examinations the patient with tuberculosis was never out of his mind, and, indeed, he wrote on the wider social aspects of the disease. He was President of the British Tuberculosis Association in 1936-1938, a member of the consulting staff of King Edward VII Sanatorium, Midhurst, and for many years the editor of *Tubercle*. He was also one of the vice-presidents of the Thoracic Society when it was founded.

He had a particular interest and unique experience in the morbid anatomy and histology of the pneumoconioses. He published many articles on asbestosis and the "asbestosis body," and contributed the chapter on pathology in "Silicosis and Asbestosis," edited by Dr. Lanza. On this subject, again, he was concerned in the recognition of new hazards and their prevention, and was a member of the Medical Board for Silicosis and Asbestosis. On his retirement from his hospital appointment he was continuing, almost to his death, further analysis of the large number of cases of these diseases he had seen from the Institute of Social Medicine at Oxford.

These professional achievements were carried with a modesty and charm of manner which endeared him to his acquaintances. His sense of humour was delightful, and the lunch-time table was frequently enlivened by his characteristic quiet laugh. There were large numbers of visitors to his laboratory, but all, whether a house physician investigating an unusual case, or a specialist eminent in his own field, were received cordially and helpfully. In fact, when difficult problems arose at Victoria Park it had become traditional for someone to say, "Ask Dr. Gloyne; he will know the answer." The answer given was not necessarily the easy way, but the future showed it was usually correct.

It was this clarity of mind, together with integrity of purpose, allied to his modesty and innate kindliness, which has made his immense circle of friends sincerely mourn his loss.

K. F. W. H.

# BRITISH TUBERCULOSIS ASSOCIATION

## Research Committee

*Annual Report, October, 1950*

The B.T.A. Research Committee has been in existence since 1947. It was formed in order to co-ordinate and sometimes initiate ideas of research into tuberculosis with the large specialist membership of the Association as a background. The chief aim was to inspire and help individuals or groups of individuals, and though comparatively few workers have applied to the Committee for advice and help, the various investigations which have been and are being carried out are based on this principle. In several instances the Committee has had the privilege of co-operating with other bodies and consultation with governmental departments has been undertaken where necessary. It will be seen that there has been no wish to do more than provide a sorting-house for ideas—indeed, little more at this stage than to establish the usefulness of the Research Committee to the members of the Association and other workers in this field.

At the start of the year a formal constitution for the Research Committee was approved by the Council of the Association. It was agreed that the membership should not be representational, but dependent on personal qualities and distinction. In addition to the major body, the practice of having a Working Party (of largely different composition) was continued. Each committee met four times in 1949-50, and there were several meetings of additional *ad hoc* subcommittees.

An important part had been taken in the initiation of the two most recent Medical Research Council (tuberculosis) investigations—the second PAS/Streptomycin Trial and the very important Tuberculin Testing Survey.

Representatives of the Committee sat on the joint committee which supervised the former, and members also participated in the M.R.C. Committee which co-ordinated the survey.

Completed is a small pilot trial with a Thiosemicarbazone (T.B.1/698), undertaken at five separate institutions on rather advanced cases of pulmonary tuberculosis. This drug has achieved wide popularity in Germany, and is on sale in this country. The published reports do not suggest that it is anything like as potent as streptomycin, and, so far as it went, the pilot trial indicated that whilst T.B.1 has probably some tuberculostatic activity, it is not of a very striking character. However, animal experiments suggest that there may be an additive effect when given with streptomycin and that the drug may be used to replace P.A.S. when the latter is badly tolerated; for these reasons the Committee is co-operating with the N.W. Tuberculosis Society in preparing a controlled investigation on a more favourable type of case.

Throughout the year a panel of thoracic surgeons and a pathologist have carried out an investigation which, it is hoped, will throw light on the incidence and nature of tuberculous tracheo-bronchitis in this country. At a number of institutions a true sample of patients on admission has been submitted to bronchoscopy, and these and clinical findings will be collated and analysed. As an additional procedure sections of bronchi from resected lungs are being examined and correlated with previous bronchoscopic findings.

It is unlikely that histoplasmosis is endemic in the British Isles, but feeling that even negative findings would be of value, the Committee has organised

a survey, in student entries to a number of London medical schools and in chest clinics. The survey will be extended to South Wales and, it is hoped, to Scotland.

Starting also this autumn will be a controlled trial to determine the value of streptomycin in tuberculous endometritis. This, in conjunction with the Royal College of Obstetricians and Gynæcologists, is being carried out at a number of important centres under the supervision of a joint committee.

Included in the current programme is a small investigation to determine the persistence of allergy following B.C.G. vaccination. Three mental institutions will take part over a period of years, and possibly the trial will be extended further.

Much of the work of the year has been concerned with preparations for the trials which will begin this autumn. In addition, a subcommittee is in existence for the purpose of considering nutritional aspects in tuberculosis. The Committee has further interested itself in problems of tuberculosis in the colonies, more especially West Africa and the Gold Coast.

Applications for advice from individual members of the Association have been received and answered. The Committee has more particularly associated itself with a proposed individual survey of tuberculosis in seamen.

It must be obvious that within the limits imposed by the type of research which alone is possible to it, the Committee has not been idle. So far as that aspect denoted by the word "co-ordination" is concerned, there is still much more to be done, and this depends on individual workers keeping the Committee up to date with regard to the research upon which they are engaged. Indiscretion and breach of confidence are very carefully guarded against by its aims and constitutions.

The financial resources of the Committee are not great, and though so far little that requires such an outlay has been undertaken, it would undoubtedly be a great help if money were available for research grants. Though influential, the Association is not a rich body and the future needs of its research arm will have to be met from other sources. Those organisations or individuals who are interested in research into tuberculosis are invited to give financial support to the work of this Committee.

The members of the Committee are Professor F. R. G. Heaf, Dr. Norman Tattersall, Dr. G. S. Todd, Dr. Stephen Hall, Dr. I. M. Macgregor, Mr. W. Cleland, Dr. Marc Daniels, Dr. L. E. Houghton, Dr. J. V. Hurford, Dr. A. Morland, Professor R. Cruickshank, Dr. K. F. W. Hinson, Dr. K. Perry, Dr. G. Marshall, Mr. B. Benjamin (Statistician, L.C.C.). The honorary secretaries are Dr. J. V. Hurford, King George V Sanatorium, Godalming, and Dr. Maher Loughnan, Colindale Hospital, N.W.9; the honorary treasurer is Dr. G. S. Todd, King Edward VII Sanatorium, Midhurst.

# REVIEWS OF BOOKS

*Die Tuberculose der Haut.* By K. W. KALKOFF. Monograph. Thieme Verlag, Stuttgart. 1950.

Kalkoff's wide experience in skin tuberculosis has enabled him to produce a small monograph (92 pages) which contains everything which the dermatologist and general physician with experience in skin tuberculosis wants to know.

A busy hospital such as the Allgemeine Krankenhaus St. Geirge, Hamburg, provides ample opportunities for studying this special subject. Lewandowsky's monograph on tuberculosis of the skin was produced at this hospital in 1916.

Every aspect of tuberculosis of the skin is discussed. Bacteriology, immunobiology and histopathology are well considered. The clinical manifestations of all tuberculous skin entities are discussed and the differential diagnoses given. It is a pity that no photographs were included; it would have enhanced the value of this monograph.

The second part of the book is devoted to the treatment of skin tuberculosis. It is divided into general measures comprising sunlight, U.V.L., diet; local treatment consisting of surgical methods, X-rays, Grenz-rays, radium, Finsen, Kromayer and $CO_2$ treatment.

Vit-$D_2$ treatment is given an extensive consideration. It will interest the British reader to know the results of treatment with thiosemicarbazone. They are very encouraging, and in the author's opinion lupus vulgaris cases were kept free from clinical manifestations for at least two years. The reader's attention is drawn to this chapter.

The end of the book is devoted to rehabilitation and prevention of lupus vulgaris. Sixty-three references are given which are all in German.

H. H.

*Die Sexualität Bei Tuberkulösen.* 1950. Georg Thieme Verlag, Stuttgart.

The belief that the sexual urge in tuberculous patients is increased is widespread. The author of this wordy report sets out to ascertain the correctness of this assumption.

He psychiatrically examined 600 tuberculous patients from this point of view—300 men and 300 women. Each of these two groups consisted of 100 mild, 100 medium and 100 severe cases. Apart from stating that his patients were " psycho-analysed " no description of his procedure of examination is given; in view of the large numbers of patients studied, and in view of the superficial nature of the material presented, the possibility of a classical psycho-analysis can be excluded.

His investigations concerned sexual sensation, sexual affect, libido and potency. Again, the term " libido " is used in a sense different from the accepted definition. It is meant to signify the sexual urge with its emotional components.

He found that in mild cases of tuberculosis potency as well as libido are increased, and he attributed this increase to toxæmia. Day and night dreams with a manifest sexual content and masturbatory practices are common, especially in sanatorium patients. In severe cases of tuberculosis intellectual ability and will-power diminish; there is also a diminution of potency and of libido. These patients crave affection and tenderness, but are incapable of reciprocating a gratification of these wishes.

Doctors should give due regard to the marital difficulties of their tuberculous patients.

Twenty-five references are given, all of them German. E. W.

## BOOKS RECEIVED

THE following books have been received and reviews of some will appear in subsequent issues:

*Bronchoesophagology.* By C. Jackson and C. L. Jackson. Philadelphia: W. B. Saunders Co.

*Thoracic Surgery.* By R. H. Sweet. Philadelphia: W. B. Saunders Co.

*Les Maladies des Bronches.* By J. Lecœur. Paris: Vigot Frères.

*Pneumonies à Virus et Pneumonie Primitive Atypique.* R. François. Paris: Vigot Frères.

*Anales et Catedra y Clinica de la Tuberculosis.* Buenos Aires: Velez Sarsfield.

# NOTICES

## NATIONAL ASSOCIATION FOR THE PREVENTION OF TUBERCULOSIS

### The Annual Report, 1949-50

This comprehensive report reviews a number of current events in relation to tuberculosis, stresses the fact that some 400 people die every week in England and Wales from this disease alone, and compares the death rate of 51·4 per 100,000 of the population in this country with that in other countries—for example, Denmark 30, U.S.A. 33, Scotland 72, Italy 84, Brazil 246, and India 200-400. It emphasises the fact that prevention and treatment of tuberculosis is handicapped not only by lack of housing but by the shortage of nurses in the sphere of tuberculosis. The contribution of B.C.G. in relation to prevention is noted, and the newer remedies like streptomycin and P.A.S. receive attention. The N.A.P.T. art therapy scheme, introduced by Mr, Adrian Hill, deserves special mention, and art therapists are now being encouraged to visit several sanatoria. The N.A.P.T. continues to pay attention to post-graduate courses for doctors, health visitors and administrative officers on behalf of the Tuberculosis Educational Institute. Altogether the N.A.P.T. is to be congratulated on an excellent year's work.

## THE NATIONAL TUBERCULOSIS ASSOCIATION OF AMERICA

The National Tuberculosis Association will hold its 47th Annual Meeting from May 14 to 18, 1951, in Cincinnati, Ohio. Meeting at the same time will be the Association's medical section, the American Trudeau Society, and also the National Conference of Tuberculosis Secretaries.

While the programme has not been completed, plans call for five medical sessions, at which papers will be presented on antibiotics in tuberculosis treatment, laboratory investigations, surgery in tuberculosis, non-tuberculous diseases of the chest, and other subjects of particular interest to thoracic specialists.

There will be two public health sessions at which preliminary plans call for sessions on the establishment of permanent tuberculosis control facilities and problems connected with the care of tuberculosis patients in the home. There will also be a joint medical and public health session.

Arrangements are being made for the display of exhibits on both medical and public health subjects.

## THORACIC SOCIETY

The next meeting of the Thoracic Society is to be held at the Royal College of Surgeons, London, on February 23 and 24.

## THE ROYAL COLLEGE OF NURSING

The Public Health Central Sectional Committee of the College is arranging a conference in the Cowdray Hall, Henrietta Place, at 2.15 p.m. on Saturday, January 13. The subject of the conference is "The Administration of

the Tuberculous Health Visiting Service." The subject is to be opened by Dr. G. E. Godber, Deputy Chief Medical Officer, Ministry of Health. Dr. Philip Ellman will preside.

## NORTH-EAST METROPOLITAN REGIONAL HOSPITAL BOARD

### Mass Radiography Unit in the City of London

Through the helpful co-operation of the Corporation of London a Mass Radiography Unit is now operating at the Mass Radiography Centre, 20, Golden Lane, London, E.C.1.

The unit will remain in the city for some months. Applications for examination, either from firms or individuals, should be directed to the Organising Secretary, Mass Radiography Unit 6D, Finsbury Health Centre, Pine Street, E.C.1, when definite bookings will be made. There are separate sessions for men and women.

## FILM ON OXYGEN THERAPY

A new 16-mm. sound film entitled " Oxygen Therapy," suitable for medical, nursing and other professional audiences, has just been produced by Kinocrat Films, Ltd., London, for Oxygenaire, Ltd., manufacturers of oxygen-therapy equipment.

The film runs for thirty-five minutes and is in two parts. Part I (465 ft.) covers the history of the clinical use of oxygen, details the physiological aspects of oxygen in the lungs, blood stream and blood plasma, and explains the symptoms and classifies the main types of anoxia. Part II (785 ft.) demonstrates the techniques of oxygen administration by face masks, oxygen tents, etc., to infants, children and adults, and shows in detail the construction of the latest forms of oxygen-therapy equipment. Other essential factors in oxygen therapy, such as various fire precautions, are also included in this section.

## INDUSTRIAL INJURIES INSURANCE

### Tuberculosis to be Industrial Disease for Certain Nurses and Other Health Workers

Tuberculosis is to be prescribed by the Minister of National Insurance as an industrial disease for nurses and other health workers whose employment brings them into close and frequent contact with tuberculous infection.

The effect of prescribing tuberculosis as an industrial disease for these nurses and health workers is to make the benefits of the Industrial Injuries Act available to them if they develop tuberculosis as the result of their employment. Industrial injury benefits are higher than those for ordinary sickness under the National Insurance Act.

The report of the Industrial Injuries Advisory Council, which has been accepted by the Minister, recommends that " disease due to tuberculous infection might properly be prescribed in relation to those persons having close and frequent contact with tuberculous infection by reason of their employment in nursing, treating medically, or attending upon, patients suffering from tuberculosis or by reason of their employment in a service ancillary to such nursing, treatment or attendance, or by reason of their employment as laboratory workers, pathologists, post-mortem workers or research workers engaged in research into tuberculous disease."

It also recommends that the disease should be presumed to be due to the nature of the relevant employment unless the contrary is proved. The period of presumption should begin six weeks after the claimant's entry into the employment and end two years after the date of leaving the employment.

The report emphasises that, in the interests of the Insurance Fund, it is of the utmost importance that the greatest possible care should be exercised in deciding all claims. Because of the difficulties of determining the source of infection of tuberculosis, a disease common to the whole population, the Council consider that the fullest use should be made of specialists in tuberculosis when claims are decided.

The full report by the Ministry of National Insurance is published by His Majesty's Stationery Office, Cmd. 8093,1950.

## REPORT OF THE MEDICAL OFFICER OF HEALTH, CITY OF GLASGOW

We have just received the annual report for 1949 from the Medical Officer of Health, Dr. Stuart Laidlaw, and in a reference to tuberculosis certain disquieting features are noted by him. He reports that the higher incidence of tuberculosis is still maintained and that the number of cases of pulmonary tuberculosis occurring during the year is the highest number recorded since 1910. He emphasises that the position of the chronic tubercular person in Glasgow is not enviable. More than half the families in Glasgow are living in one or two apartment houses and, as tuberculosis tends to attack the more poorly housed sections of the community, it is found that the majority of the tubercular cases live in accommodation of this size. Such accommodation entirely precludes the adequate isolation of the infected person, and exposes contacts to repeated and often massive doses of infection. It is little wonder that the infection rate is high and that tubercular testing of the exposed contacts has shown a large proportion of positive reactors. Glasgow today, says Dr. Laidlaw, has over 12,000 tubercular persons on the registers of the department, this number being 3,000 more than the figure prior to the war. Priority rehousing is an absolute essential.

The introduction of the National Health Service has certainly done nothing to alleviate the problem of tuberculosis in Glasgow. It would be true to state in fact that the position has worsened since the introduction of the Act. The reasons for this state of affairs are not difficult to seek—firstly, the inability of the Hospital Board to increase materially the number of beds in sanatoria for tuberculosis patients, and secondly, the poor housing conditions which make the isolation of the patient virtually impossible in the large majority of homes. The sub-division of the tuberculosis service between the Regional Board and the Local Health Authority has been a disservice to tuberculosis as a whole.

Among further references to the problem of tuberculosis in Glasgow he says that experience has shown that hospital admission departments should be instructed to give priority to urgent cases of tuberculosis recommended by the Medical Officer of Health on domiciliary grounds. This is essential if a satisfactory liaison between the domiciliary and curative sections into which the Act divided the service is to be maintained.

## CORRIGENDUM

*Streptomycin in the Treatment of Tuberculous Meningitis*

We regret that in a summarised version in our last issue of an already summarised report $\frac{(Med.1/C.J.D.)}{S/1950/4}$, transmitted to us, but not, as erroneously stated, prepared by Dr. J. Balfour Kirk on behalf of the Ministry of Health, certain impressions were conveyed which we should like, in the interests of accuracy, to correct.

Under the heading General Results, " early treatment " should read " skilled early treatment." The second sentence of the second paragraph of this section should read: " Of the 16 not fit, 2 had genito-urinary tuberculosis, 8 had not fully recovered a year previously and 6 (under the age of four) were described as mentally retarded."

Under Methods of Treatment it would be more accurate to substitute " more fully " for " in detail."

Under Assessment of Results it should have been made clear that each hospital had its own standards which were finally related to a centrally determined standard.

In the final paragraph of the report " miliary tuberculosis " should have read " tuberculous meningitis."